BPT
2.

Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

2001 Annual Report

Western Pacific Regional
Fishery Management Council
1164 Bishop Street, Suite 1400
Honolulu, Hawaii 96813

Cover photo: Onaga or the Queen of the Sea is a prize menu for the people of Guam. These gracious Sea Queens are caught in deep black waters over a 1000 feet with a "kotdet" or wild hibiscus fibers once used as traditional fishing lines. These fish are known for their jubilant array of bright red and orangish colors, along with their long extended tail tips. These fish are easily caught without struggle as they are pulled up from these great depths.

Photo from http://peskadot.web.gu/page3/

A report of the Western Pacific Regional Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No.**NA07FC0025**

Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

2001 Annual Report

April 2003

Prepared by the Bottomfish Plan Team and Council Staff for the
Western Pacific Regional Fishery Management Council
1164 Bishop Street, Suite 1400, Honolulu, Hawaii 96813
Tel: (808) 522-8220, Fax: (808) 522-8226

Table of Contents

page

1.0 INTRODUCTION 1
1.1 Definition of Descriptors 1
1.1.1 Landings information 1
1.1.2 Effort information 4
1.1.3 Participation information 4
1.1.4 Economic information 4
1.2 Definition of Indicators 4
1.2.1 Aggregate Catch-Per-Unit-Effort 4
1.2.2 Mean Fish Size 4
1.2.3 Percent Immature 5
1.2.4 Spawning Potential Ratio 5
1.2.5 Economic Indicators 5

2.0 AREA SUMMARIES 5
2.1 American Samoa 5
2.1.1 Descriptors 5
2.1.2 Indicators 6
2.1.3 Recommendations 6
2.2 Guam 6
2.2.1 Descriptors 6
2.2.2 Indicators 7
2.2.3 Recommendations 7
2.3 Hawaii 7
2.3.1 Descriptors 7
2.3.2 Indicators 8
2.3.3 Recommendations 10
2.4 Northern Mariana Islands 11
2.4.1 Descriptors 11
2.4.2 Indicators 11
2.4.3 Recommendations 12
2.5 Region-Wide Recommendations 12

TABLES

1. Regional Summary of 1999 Bottomfish Statistics 2
2. Bottomfish Management Unit Species (BMUS) Names 3

APPENDICES

1. American Samoa 1-1
2. Guam 2-1
3. Hawaii 3-1
4. Northern Mariana Islands 4-1
5. NMFS 2001 Administrative Activities 5-1
6. USCG and NMFS 2001 Enforcement Activities 6-1
7. 2001 Bottomfish Plan Team Members 7-1
8. Glossary 8-1

SUMMARY OF ISLAND AREA TABLE OF CONTENTS

Appendix 1. American Samoa

Contents

1. Summary 1-2
2. Historical Annual Statistics 1-3
3. Introduction 1-4
4. Recommendations 1-5

Tables

1. American Samoa 2001 Estimated Total Bottomfish Landings 1-6
2. American Samoa 2001 Estimated Commercial Landings by Species 1-7
3. American Samoa 2001 Bottomfish Bycatch 1-8

Figures

1. American Samoa Bottomfish Landings 1-9
2. American Samoa annual estimated commercial bottomfish landings 1-10
3. American Samoa annual estimated bottomfish hours and trips 1-12
4. American Samoa annual estimated number of boats landing bottomfish 1-13
5. American Samoa average price of bottomfish 1-14
6. American Samoa annual bottomfish CPUE 1-15
7. American Samoa average inflation-adjusted revenue per trip landing bottomfish 1-16

Appendix 2. Guam

Context

1. Summary 2-2
2. Historical Annual Statistics 2-3
3. Introduction 2-4
4. Recommendations 2-6
5. List of Tables and Figures 2-7

Tables

Page

1. Guam 2001 expanded creel survey composition of allocated bottomfish management unit species (BMUS) 2-8
2. Guam 2001 commercial bottomfish average price 2-8

Figures

1a. Guam harvest of BMUS and all bottomfish 2-9
1b. Guam harvest of BMUS Species 2-9
2a. Total and commercial BMUS harvest 2-12
2b. Total and commercial BMUS revenue 2-12
3a. Estimated bottomfish boat hours 2-15
3b. Estimated bottomfish trips 2-15
4. Guam bottomfish fishery participation 2-17
5. Average bottomfish prices 2-19
6. Guam bottomfish CPUE 2-21
7. Guam average revenue per trip 2-23
8a. Jacks/Trevallys: Harvest 2-25
8b. Jacks/Trevallys: Revenue 2-25
9a. Snappers: Harvest 2-27
9b. Snappers: Revenue 2-27
10a. Groupers: Harvest 2-29
10b Groupers: Revenue 2-29
11a. Emperors: Harvest 2-31
11b. Emperors: Revenue 2-31
12a. Guam 2001 Bottomfish Bycatch: Non-charter 2-33
12b. Guam 2001 Bottomfish Bycatch: Charter 2-33
12c. Guam 2001 Bottomfish Bycatch: Summary 2-34

Appendix 3. Hawaii

Contents

1. Summary 3-2
2. Historical Annual Statistics 3-3
3. List of Tables 3-6
4. List of Figures 3-6
5. Introduction 3-8
6. Recommendations 3-8

Tables

1. Hawaii Bottomfish species landings and prices, 1996 & 1997 3-21
2. Ho'omalu zone bottomfish vessel, income statement, 1997 3-22
3. Mau zone bottomfish vessel, income statement, 1997 3-23

Figures

page
1. Hawaii's bottomfish landings from the NWHI and MHI 3-9
2a. NWHI BMUS species composition of landings per trip by weight, for the Mau Zone 3-11
2b. NWHI BMUS species composition of landings per trip by weight, for the Hoomalu Zone 3-13
3. NWHI BMUS species composition of landings by weight 3-15
4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones 3-17
5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones 3-19
6. MHI species composition of landings by weight 3-26
7. MHI reported effort and participation 3-28
8. Hawaii bottomfish landings, revenue, prices, 1970-97. (Inflation adjusted) 3-31
9. Hawaii bottomfish market landings, revenue, and prices by source, 1970-present (Inflation adjusted.) 3-34
10. Hawaii bottomfish ex-vessel prices by source, 1987-present (Price adjusted for inflation) 3-37
11. Hawaii bottomfish ex-vessel prices by NWHI zone, 1989-present (Inflation adjusted prices) 3-38
12. Hawaii Bottomfish Demand 3-42
13. NWHI bottomfish inflation-adjusted revenue per trip by zone, 1989-present 3-43
14a. CPUE for Hawaiian bottomfish 3-45
14b. Partial CPUE for MHI bottomfish 3-49
14c. Partial targeted CPUE for MHI bottomfish 3-52
15. Percent Immature in Hawaiian Bottomfish Catch 3-55
16. Mean Weight of Hawaiian Bottomfish 3-57
17 Archipelago wide Spawning potential ratio (SPR). 3-59
18 Spawning potential ratio (SPR) for MHI bottomfish. 3-61
19a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE 3-63
19b. Spawning potential ratio (SPR) for NWHI bottomfish using targeted CPUE 3-65
20. Research CPUE on SE Hancock Seamount 3-68
21. Armorhead Spawning potential ratio 3-71
22. CPUE for Hancock and Colahan Seamounts 3-72

Appendix 4. Commonwealth of the Northern Mariana Islands

Contents

1. Summary 4-2
2. Historical Annual Statistics for CNMI Bottomfishes 4-3
3. List of Tables 4-4
4. List of Figures 4-4
5. Introduction 4-5
6. Recommendations 4-6

Tables

page
1. CNMI Consumer Price Indices 4-8
2. CNMI 2001 commercial landings of bottomfish species 4-9
3. Bycatch during CNMI bottomfishing 4-22

Figures

1. CNMI commercial bottomfish landings and revenue 4-10
2. Number of fishermen (boats) making bottomfish landings 4-12
3. Number of CNMI bottomfish trips 4-14
4. CNMI average price of bottomfish 4-16
5. CNMI average inflation adjusted revenue per trip landing bottomfish 4-18
6. CNMI bottomfish catch in average pounds per trip 4-20

Bottomfish and Seamount Groundfish Fisheries of the Western Pacific

2000 Annual Report

1.0 Introduction

The 2001 annual report provides a set of descriptors and indicators of the bottomfish fisheries from American Samoa, Guam, Hawaii and the Northern Mariana Islands. The descriptors are designed to document recent trends in landings, effort, participation, revenue and prices. Should management action be recommended, descriptor information will aid in assessing potential impacts of the action on fishery participants. The indicators are quantifiable and measurable tools used to identify signs of stress in the stocks or the fishery. Based on changes over time in indicator levels, the Bottomfish Plan Team (BPT) may identify "yellow light" situations (i.e., where stress is first detected) and recommend that either management action or additional study be undertaken or "red light" situations where immediate management action is needed.

The annual report is organized as follows: The introduction section defines and briefly explains the descriptors and indicators. The next section briefly summarizes time trends in descriptor and indicator levels, through the current year, and recommends any areas of concern for each island area. Reports from each island area are appended. The introduction describes the history and present characteristics of the fishery. Results of the current year's descriptors and indicators are presented in detail, in relation to past temporal trends. Figures are supported with information on source of the data, methods of calculation, and data interpretation. Table 1 summarizes 2001 bottomfish statistics for the region. The appended report from each area includes a summary of the new area specific and region-wide recommendations. Finally, additional appendices contain information on NMFS 2001 administrative and enforcement activities, habitat conditions, protected species interactions, and 2001 BPT membership.

Table 2 lists scientific, common English and local/indigenous names for bottomfish management unit species (BMUS) for each area (American Samoa, Guam/Northern Marianas, and Hawaii).

1.1 Definition of Descriptors

The fishery descriptors are defined as follows:

1.1.1 Landings information

Time series information on aggregate catch for each island area shows recent trends in total bottomfish harvest. For American Samoa and Guam, estimates of both the commercial landings and the total landings (combined commercial, recreational and subsistence) are available. For Hawaii and the Northern Marianas, landings information represents only the commercial harvest.

Table 1. Regional Summary of 2001 Bottomfish Species

				Hawaii			
	AS	GU	NMI	All	MHI	Mau	Hoomalu
BMUS Landings (lb)	47,285	121,427	57,328	608,523	322,523	50,000	236,000
Revenue ($)	79,193	89,844	175,345	2,151,000	1,266,000	141,000	744,000
No. Of Boats	18	337	75	---	379	6	5
No. Of Trips	331	7,820	834	---	2593	55	41
CPUE	15.2 lb/hr	3.8 lb/hr	69 lb/trip	---	184 lb/trip	916 lb/trip	5,757 lb/trip
SPR	---	---	---	0.20-0.64	note 1	note 2	note 2

Notes:

1) Species with Spawning Potential Ratio near or below threshold level of 0.20, indicating localized subarea depletion: MHI onaga ("targeted" SPR = 0.03); MHI ehu ("targeted" SPR = 0.11)
2) Healthy (SPR > 0.20) for all species (Mau Zone=0.36, Hoomalu Zone=0.64)

Table 2. Bottomfish Management Unit Species (BMUS) Names

(Absence of an indigenous name implies no local name established or area is not within the species' geographic range.)

Scientific	English Common	American Samoa	Guam/CNMI	Hawaii
Bottomfish:				
Aphareus rutilans	red snapper/silvermouth	palu-gutusiliva	maraap tatoong	lehi
Aprion virescens	gray snapper/jobfish	asoama	tosan	uku
Caranx ignobilis	giant trevally/jack	sapoanae	tarakito	white ulua/pau'u
C. lugubris	black trevally/jack	tafauli	trankiton attilong	black ulua
Epinephelus fasciatus	blacktip gouper	fausi	gadao matai	
E. quernus	sea bass			hapu'upuu
Etelis carbunculus	red snapper	palu-malau	guihan boninas	ehu
E. coruscans	red snapper	palu-loa	onaga	onaga
Lethrinus amboinensis	ambon emperor	filoa-gutumumu	mafuti/lililok	
L. rubrioperculatus	redgill emperor	filoa-pa'o'omumu	mafuti tatdong	
Lutjanus kasmira	blueline snapper	savane	sas/funai	ta'ape
Pristipomoides auricilla	yellowtail snapper	palu-i'usama	guihan boninas	yellowtail kalekale
P. filamentosus	pink snapper	palu-'ena'ena	guihan boninas	opakapaka
P. flavipinnis	yelloweye snapper	palu-sina	guihan boninas	yelloweye opakapaka
P. seiboldi	pink snapper		guihan boninas	kalekale
P. zonatus	snapper	palu-sega	guihan boninas/gindai	gindai
Pseudocaranx dentex	thicklip trevally		terakito	butaguchi/pig ulua
Seriola dumerili	amberjack		guihan tatdong	kahala
Variola louti	lunartail grouper	papa	bueli	
Seamount Groundfish:				
Beryx splendens	alfonsin			kinmedai (Japanese)
Hyperoglyphe japonica	ratfish/butterfish			medai (Jap.)
Pseudopentaceros richardsoni	armorhead			kusakari tsubodai (Jap.)

In Hawaii, changes in species catch composition are provided for the Main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI). Statistical tests for consistency in catch composition over time and between areas are included. Where possible, descriptor information has been presented for each NWHI management zone: Hoomalu and Mau. For 2001, pounds landed by species are presented in tabular form for each area except Hawaii. For Hawaii, NWHI BMUS landings by species are provided for 1986 through 2001.

1.1.2 Effort information

Effort is measured in number of trips for Hawaii and the Northern Marianas, and in both hours fished and trips taken for American Samoa and Guam.

1.1.3 Participation information

Estimates of the number of vessels making bottomfish landings are provided for all areas.

1.1.4 Economic information

Time trends in economic performance are characterized by plots of total ex-vessel revenue, aggregate average price levels, and for Hawaii, price trends over time for major species. In time-series of prices and revenues, it is appropriate to adjust value for the rate of inflation so that values throughout the time period are comparable (based on a consistent purchasing power for the dollar). Both the unadjusted and adjusted aggregate average price and aggregate revenues are plotted to clarify the relative change over time.

1.2 Definition of Indicators

Indicators were developed as tools for identifying signs of stress in the stocks or the fishery which deserve further investigation and/or a management response. Analyses consider how the indicators change over time. Indicators for Hawaii include 95% confidence intervals. To the degree possible, similar variance estimates are expected from the other areas in future annual reports. The indicators are defined as follows:

1.2.1 Aggregate Catch-Per-Unit-Effort

If the current year's aggregate catch-per-unit-effort (CPUE) is less than 50% of the average aggregate CPUE for the first three years of available data, there may be cause for concern. CPUE information is available for all areas; research CPUE is available for SE Hancock Seamount for all years since 1985, except in 1992 and 1994-2001.

1.2.2 Mean Fish Size

If there has been a significant reduction in mean fish size for a species over time, the stock may be stressed by the fishery. Mean size information is provided for nine species in Hawaii.

No mean size information was available at this time for American Samoa, Guam or the Northern Marianas.

1.2.3 Percent Immature

If over 50% of the catch for a species is below the size of first maturity, the stock may be stressed by the fishery. Information for this indicator by species is available only from Hawaii.

1.2.4 Spawning Potential Ratio

The spawning potential ratio (SPR) is the ratio of the spawning stock biomass per recruit, at the current level of fishing, to the spawning stock biomass per recruit that would occur in the absence of fishing. According to the overfishing definition contained in the Bottomfish FMP (Amendment 3, 1990), if SPR is less than or equal to 0.20, recruitment overfishing has occurred (i.e., spawners have been reduced to 20%, or less, of their unexploited stock level). Data to calculate SPR were not available from Guam or the Northern Marianas. An estimate of the "worst case" SPR was calculated for American Samoa's bottomfish complex using Dory Project data to estimate the virgin population CPUE and information on percent of immature fish from Hawaii. In Hawaii, SPR was calculated for five major species in the Hoomalu and Mau Zones, of the NWHI, and the MHI; some SPR values changed slightly from previous year's reports due to improvement in the calculations. SPR for armorhead was calculated annually since 1985, except for 1992 and 1994-2000.

1.2.5 Economic Indicators

Revenue per trip plots are presented for all areas except the MHI. A more valuable indicator for the commercial fisheries, which may be available in the future, would be net revenue (ex-vessel revenue minus costs per trip). Net revenue is available only from the Hoomalu Zone and Mau Zone in Hawaii.

2.0 AREA SUMMARIES

2.1 American Samoa

2.1.1 Descriptors

During 2001, a total of 18 local boats landed an estimated 47,285 pounds of bottomfish, (about 68.5% increase from last years landings) Revenues for the domestic commercial fishery this year was estimated around $79,193 (a 43.4% increase from last year) with all the catch being sold locally. The CPUE for 2001 (15.2 lb/hr) was not less than 50% of the aggregate CPUE for the first 3 years of available data.. In 2001, effort (trips and hours) increased.

2.1.2 Indicators

CPUE (pounds per hour), though relatively stable (at about 10 lb/hr) in the early 1990's, increased in 1996 to 14.8 lb/hr, mainly due to improved sampling. CPUE declined by about 7% in 2001 to 10.2 lb/hr and but rebounded and increased in 2001 to 15.2 lb/hr, the highest CPUE since it was recorded in 1982. This level is not less than 50% of the average aggregate CPUE for the first three years of available data (9.7 lb/hr), indicating no cause for concern. Bottomfish revenue per trip (as opposed to total revenue) increased for the third straight year in 2001, after a three-year declining trend.

2.1.3 Recommendations

2001 Recommendations

A. DMWR should start preparing a sampling program for the Alias fishing out of Vatia and Anunuu (not included in the normal sampling area) to improve coverage of the fisheries.

2.2 Guam

2.2.1 Descriptors

The fairly large fluctuations over time in bottomfish landings in Guam appear to be due more to entry and exit patterns of fishermen, rather than changes in fish stocks. The number of highliners fishing in the area doubled from 1993 to 1994, increasing the total commercial BMUS harvest and revenue by nearly 300% during that year. In 2000, the total BMUS landings increased by 14%, making 2000 the second-highest BMUS landings in the 15 year data history and 57% above the 15-year average. 2001 landings decreased by 17% from 2000, but was still 23% above the 15-year average.

The decrease in total bottomfish and total BMUS in 2001 was due to historically annual fluctuations of bottomfish landings that is usually due to highliners entering or leaving the fishery during a given year. In 2001, an decrease in BMUS landings was due to decreases in landings of jacks, groupers, and snappers (26.1%, 9.5%, and 31.4% respectively). Emperor landings, however, increased by about 13%. Landings of all groups remained above the long-term average.

The harvest of total bottomfish and BMUS from the charter sector also decreased in 2001, 13% and 7% respectively. These boats tend to release a majority of their catch, although their catch tends to be juvenile goatfish and triggerfish.

The adjusted average price for bottomfish has not shown consistent marketing trends. This is believed to have resulted from the seasonal supply of pelagic fish and difficulties in developing a consistent market for locally caught fish. In addition, imported fish from other islands around the region have contributed to the continued marketing problem for local fishermen. The 2001

inflation-adjusted average bottomfish price of $3.28 continues a decrease from last year and is down 9% from 1999 ($3.60). The 2001 average price was 23% below the long term average.

2.2.2 Indicators

Total and BMUS bottomfish harvest decreased in 2001, except the charter component of the total bottomfish harvest. Total bottomfish landings decreased 17%, with the non-charter and charter components decreasing 18% and increasing 45% respectively. Total BMUS landings decreased 13%, with the non-charter and charter components decreasing 15% and 8% respectively. The non-charter components made up 98% of the total bottomfish and BMUS harvest. The CPUE for all bottomfish increased slightly, 3%, while the non-charter CPUE remained the same. The charter CPUE increased 23%. The commercial sales of BMUS species increased 16% in 2001, although a 10% decrease was observed with the commercial adjusted revenue. The number of boats engaging in bottomfishing, overall bottomfish trips, and total hours spent bottomfishing increased 8%, 9%, and 3% respectively.

2.2.3 Recommendations

2001 Recommendations

1. Integrating the offshore and inshore creel census data and the fine-tuning of the offshore expansion program is ongoing. Invaluable technical assistance from NMFS has enabled DAWR to move closer towards providing statistics of confidence, mean fish size, and separating the shallow and deepwater complexes. Inputting the remaining five years of offshore data should be completed in 2002, although the loss of staff and an increase in fisheries projects have made completion of this recommendation slow.

2. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. DAWR's fisheries staff has discussed making progress towards completing this study during 2002.

3. With additional funding from the WPacFIN program and technical assistance from NMFS, Guam's DAWR should establish mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes.

2.3 Hawaii

2.3.1 Descriptors

Main Hawaiian Islands: Only commercial data are available for both the MHI and NWHI fisheries, even though the MHI recreational/subsistence catch is estimated to be about equal that of commercial landings. In 1988, there was a dramatic increase in MHI bottomfish landings due to a bonanza uku (gray snapper) harvest. A steady decline in total landings occurred until 1993,

which was the lowest recorded annual value at the time. Landings increased 32% in 1994 and remained high through 1997, although CPUE was at a 12 year low in 1997. Participation and landings have declined over the past two years while CPUE has increased 29% in that same period. 2001 landings of 322,523 pounds are the lowest total landings in recent records and may be correlated to a 32% decrease in the total number of trips from 2000.

Total ex-vessel revenue from the MHI shows a general decline from 1988-1996 and has stabilized since. 2001 inflation adjusted revenue was the lowest since 1974, and 61% lower than 1988's value. Revenue decreased 23% in 2001, and remains lower than the long-term average.

NWHI Mau Zone: Mau Zone 2001 landings increased 7% from 2000 due to a 17% increase in number of trips from 47 in 2000 to 55 in 2001. Catch per trip decreased by 13% in this zone. The total number of boats remained stable at 6.

NWHI Hoomalu Zone: Hoomalu Zone 2001 landings increased 11% from 2000. Five boats fished in 2001, the same as in 2000. The number of trips increased by 14% from 36 to 41. Bottomfish landings per trip decreased by 9.7% based on NMFS CPUE.

Available revenue data are not separated by zone. Overall NWHI inflation adjusted revenue had been relatively stable. With the 20% decline in 2000 continuing to decrease in 2001 by 21%.

2.3.2 Indicators

Hawaii Archipelago-wide:

SPR values for the five major BMUS species in 2001 are all above the 20% critical threshold level, that defines recruitment overfishing under the FMP, when viewed on an archipelago-wide basis. Of these species, onaga is still the lowest with a 2001 value of 25%. Implementation of the state's management plan should help improve the condition of onaga in the MHI and continue to increase the archipelago-wide SPR.

SPR values are also presented on a management zone basis (MHI, Mau Zone, Hoomalu Zone) for the purpose of determining locally depleted resources.

MHI: CPUE in 2001 decreased slightly from 2000 but remained above 1997 and 1998 levels. Recent CPUE values are approximately one-fourth the early (baseline 1948-50) values, signifying local depletion in the MHI. Most of the more commercially important species in the MHI have had relatively stable mean weights since 1984. Hapuupuu's mean weight dropped sharply in 1993 and has continued to be low. The small number of fish upon which the annual estimates are based may bias the result. However, with so many years in a row recording low mean weights, it is likely that marketed fish size has actually declined for MHI hapuupuu. Such a decline in mean size indicates increased stress on the MHI hapuupuu resource. These values do not exhibit a continuing decline, in fact, the 1997-2000 values are slightly greater than the 1995

lowest value.

For the eighth year 95% confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature). For the sixth year SPR values were calculated using both aggregate CPUE, as in previous years, and targeted CPUE, which gives a more accurate picture for individual species. 2001 aggregate CPUE SPR values for all five major species declined but remained above the 20% critical level, except for onaga and opakapaka: onaga (0.04), opakapaka (0.19), hapuupuu (0.28), ehu (0.24), and uku (0.24). The use of targeted CPUE showed a different picture for the four species where targeted trips are available. Here, ehu SPR is much worse than indicated using aggregate CPUE (SPR = 0.08), whereas SPR values for opakapaka and uku are much higher than previously indicated (SPR = 0.35 and 0.33, respectively). Onaga's SPR remains consistent when using targeted or aggregate CPUE and has now been below 0.20 for the past 10 years and ehu for all of the last 10 years (using targeted CPUE).

NWHI Mau Zone: The NMFS CPUE data are only available for the NWHI fishery as a whole since 1984 and by zone since 1988. The NWHI (combined Mau and Hoomalu Zones) NMFS CPUE steadily decreased from 1987 to 1992, rose in 1993, and then declined from 1994-96. CPUE rose in 1997 to the 1993-94 level, but dropped slightly in 1998. CPUE increased in 2000 at 513 lb/day and decreased in 2001 to 467 lbs/day. The Mau Zone NMFS CPUE had been steadily decreasing since 1989, but increased in 1993 and 1994. In 1997, NMFS CPUE rose 49%. The CPUE declined 15% in 1998 and 7% in 1999 to 337 lb/day. Mau Zone CPUE dropped to 260 lbs/day in 2000 to similar levels as in 1992 and 1993, but decreased by 9% in 2001. Mean weights of fish in the Mau Zone continue to exhibit year to year fluctuations, but are generally at much higher values than MHI mean weights. The percent of immature fish in the 2001 Mau Zone catch was just under 50% for all species evaluated.

SPR values in the Mau Zone have been decreasing since 1990 (mirroring the pattern in the HDAR CPUE), experienced a surprising rise in 1994, returned to lower levels in 1995, followed by a continued four year increase through 1999. All values are presently above well above the critical level of 0.20, except for onaga which dropped from 30% in 2000 to 27% in 2001. Notable decrease in 2001 onaga SPR values for the Mau Zone is due to increases in the percent of immature onaga in the catches of this zone. SPR values are higher in the NWHI than the MHI because most of the catch is mature fish.

NWHI Hoomalu Zone: The Hoomalu Zone NMFS CPUE has been on a downward trend from since data collection began in 1988. 2001 CPUE continued to decrease to 543 lb/day from a 6-year high in 2000. Pounds per trip decreased by 19% in 2001. Mean weights of fish in the Hoomalu Zone continued to exhibit year to year fluctuations, but are still at much higher values than MHI mean weights. The percent of immature fish in the 2000 catch was just under 50% for all species evaluated.

The SPR values in the Hoomalu Zone decreased for all species. The 2001 SPR levels range from 46% to 71%.

Seamount Groundfish (Armorhead): No fishing has been allowed on the armorhead stocks of the SE Hancock Seamount since the moratorium began in August, 1986. The 1993 CPUE, calculated from research longline catches, was more than double that of the last assessment (in 1991) and nearly as high as the highest CPUE recorded since surveying began in 1985. No research cruise occurred since 1993, and future research assessment cruises are unlikely.

No SPR values were available in 2001 as no research was undertaken. In 1993, SPR within the EEZ (SE Hancock Seamount) was above 0.02, the highest since 1986, but still far below (10% of) the threshold level for recruitment overfishing of 0.20. About 99% of the known armorhead seamount habitat occurs outside the U.S. EEZ, an area which had 0.06 SPR in 1993. During February and March 1997, an oceanic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V Kaiyo Maru by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Armorhead larvae were collected from surface waters around all seamounts except for Koko Seamount.

2.3.3 Recommendations

2001 Recommendations

A. The Council should request the State of Hawaii to change the mandatory NWHI daily logbook format to include the disposition of catch, ie. live release or dead release, of the released fish.

2.4 Northern Mariana Islands

2.4.1 Descriptors

Data are available only on the commercial fishery. Landings of bottomfish seem to have significantly increased from last year (57.1% more pounds in 2001 than in 2000), to the highest level in 19 years. In 2000, bottomfish landings decreased significantly (18.2% less than 1999). This fishery continues to show a high turnover with changes in the high liners participating in the fishery, and an increased number of local fishermen focusing on reef fishes in preference to bottomfishes. In 2001, the number of vessels fishing increased to 75 following from 65 in 2000 and 51 in 1999. The number of trips more increased in 2001 to 834 which is the highest number of trips recorded.

Both the unadjusted and adjusted prices increased in 2001. The unadjusted price was the increased by 2.2% over 2000, and the adjusted price increased by 8.5% from 2000. The unadjusted price was higher than the long term average, but the adjusted price was 3% lower than the mean for the last 19 years. The total 2001 ex-vessel revenue increased steeply to $175,345, the second-highest revenue in the last 19 years.

2.4.2 Indicators

The average bottomfish catch per trip increased from 57 lb/trip in 2000 to 69 lb/trip in 2001. Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g., changes in trip length and relative amounts of bottom fishing compared to trolling or reef fishing); it is the only measure readily obtained from the commercial landings system. However, the smaller vessels commonly make mixed trips and the relative proportions of bottom fishes to pelagic and reef fishes seem to be changing. Between 1997 and 2001 the number of fishermen selling both pelagic fishes and bottom fishes decreased from 11.5 to 6.8%, the number selling both pelagic and reef fishes increased from 4.8 to 7.6%, and the number selling only reef fishes increased from 10.3 to 26.1%. Given that fishermen appear to be changing the focus of their trips to include more reef fishing and less bottom fishing, this measure is an increasingly inaccurate portrayal of the actual CPUE. It has been suggested that it may be possible to improve this measure of CPUE by using only those trips that landed bottomfish exclusively. However, in the past 5 years only 2 fishermen exclusively sold bottomfishes in 1997, 1 in 1998, none in 1999 and 1 in 2000, and 3 in 2001. These numbers are too low to be indicative of the entire fishery.

Revenues significantly incrased (70.6% more than in 2000). The unadjusted revenue and inflation-adjusted revenue for 2001 is greater than the mean for the last 18 years, and is the second highest value of the whole 19 years. This is a result of the combined effect of greater pounds landed and a higher price per pound for almost all bottomfish species.

2.4.3 Recommendations

2001 Recommendations

A. To request NMFS and the Council to assist DFW in identifying an expert who is capable of and willing to prepare otoliths of redgill emperor and then count daily growth rings.

B. To request NMFS and the Council assist CNMI by contracting a specialist to map commercial fishing banks, particularly around Farallon de Medinilla, Marpi Reef, and the closest banks to Saipan, Tinian, and Rota.

C. To request the Council merge the Bottomfish Plan Team (as well as the Crustaceans Plan Team) with the Coral Reef Ecosystem Plan Team.

2.5 Region-Wide Recommendations 2001

A. Council should support development of a comprehensive model to assess the effects on MSY, CPUE, SPR, etc. due to the concentration of effort from the establishment of area closures and MPAs.

Appendix 1

American Samoa

CONTENTS

Page

Summary 1-2

Historical Annual Statistics 1-3

Introduction 1-4

Recommendations 1-5

Tables

1. American Samoa 2001 Estimated Total Bottomfish Landings 1-6
2. American Samoa 2001 Estimated Commercial Landings by Species 1-7
3. American Samoa 2001 Bottomfish Bycatch 1-8

Figures

1. American Samoa Bottomfish Landings 1-9
2. American Samoa Annual Estimated Commercial Bottomfish Landings 1-10
3. American Samoa Annual Estimated Bottomfish Hours and Trips 1-12
4. American Samoa Annual Est. Number of Boats Landing Bottomfish 1-13
5. American Samoa Annual Bottomfish Average Price of Bottomfish 1-14
6. American Samoa Annual Bottomfish CPUE 1-15
7. American Samoa Average Inflation-Adjusted Revenue per Trip Landing Bottomfish 1-16

Summary

American Samoa's bottomfish fishery was relatively bigger between 1982 and 1986 than in recent years (Figure 1). This observation reflects a trend in the loss of skilled and full-time commercial fishermen from the fishery, the gradual depletion of newly discovered banks (e.g., 2% Bank), the shift of preference from bottomfishing to trolling and, recently, the diversion of effort by the highliner bottomfish fishermen towards longlining. The December 1992 hurricane contributed to the low 1992 landings (Figure 1) and the lowest number of trips recorded for the period 1982-1997 (Figure 3). A gradual increase in landings and revenues since 1998 converses the associated decrease in prices for the same period. A 290% increase in bottomfish exported from western Samoa contributed to the low market prices last year and again this year.

During 2001, a total of 18 local boats landed an estimated 47,300 pounds of bottomfish in the territory. Revenues for the domestic commercial fishery this year was estimated around $79,200 with all catch being sold locally. The CPUE for 2001 (15.2 lb/hr) was the highest since 1989 and also not less than 50% of the aggregate CPUE for the first 3 years of this fishery. Effort (hours and trips) has been increasing since 1998 as some of the Alias that normally troll and/or longline perform bottomfishing when trolling and longline prices and catches decline. Overall average prices slightly dropped this year but prices for Lehi and Opakapaka increased mainly due to their demand by relatively new restaurants.

Regarding some of the SFA amendments: ***Commercial*** Bottomfish Landings and Revenues statistics for American Samoa is presented in Figure 2. No bottomfish ***Recreational*** trip was recorded this year. **Recreational** fishing is more associated with the pelagic fisheries and usually never occur in this fishery. There was no ***chartered*** bottomfish trip during this year and no **bottomfish by catch was recorded this year (Table 3).** In the *Preliminary Draft of EFH, Amendment for Bottomfish, WPRFMC Feb.1998,* **the approximate MSY estimate for American Samoa** [196 nautical miles 100-fathom isobath] is estimated at 79,000 lbs. per year. Only about 40% was reached this year.

Indicators derived from current data do not dictate immediate management response at this time.

The following selected annual statistics dating back to 1982 provides a brief historical snapshot of American Samoa's bottomfish fishery

Selected Historical Annual Statistics

Year	Total Landings (lb)	CPUE (lb/trip-hr)	Adjusted Revenue	Adjusted Price/Lb.	CPI	Number of Boats
1982	64942	8.5	$191888	$3.09	100.0	27
1983	126327	10.0	$450983	$3.60	100.8	38
1984	94104	10.7	$274245	$2.96	102.7	48
1985	143225	8.1	$230353	$2.25	103.7	47
1986	95978	8.8	$225086	$2.36	107.1	34
1987	31148	11.7	$70143	$2.30	111.8	20
1988	63237	17.3	$142617	$2.36	115.3	27
1989	47482	16.7	$78328	$2.16	120.3	29
1990	14303	9.2	$27040	$2.16	129.6	19
1991	18677	9.1	$37124	$2.10	135.3	20
1992	13316	9.3	$33277	$2.50	140.9	14
1993	17518	7.3	$36487	$2.35	141.1	22
1994	44982	7.7	$91016	$2.20	143.8	19
1995	34414	9.8	$66813	$1.96	147.0	25
1996	38522	14.8	$76605	$2.03	152.5	26
1997	39863	14.7	$89257	$2.33	156.4	24
1998	15862	14.0	$38052	$2.64	158.4	16
1999	19563	12.9	$45371	$2.63	159.9	22
2000	28068	10.2	$55217	$2.13	166.7	17
2001	47285	15.2	$79193	$2.12	168.8	18
Averages	49941	11.3	$116955	$2.41		25.6
Std. Dev.	36793	3.1	$105102	$0.40		9.32

Introduction

Bottomfishing utilizing traditional canoes by the indigenous residents of American Samoa has been a subsistence practice since the Samoans settled into the Tutuila, Man'ua and Aunu'u islands. It was not until the early 1970's that the bottomfish fishery developed into a commercial scheme utilizing motorized boats. A government subsidized program, called the Dory Project, was initiated in 1972 to develop the offshore fisheries into a commercial venture, and resulted in an abrupt increase in the fishing fleet and total landings. In 1982, a fisheries development project aimed at exporting high-priced deep-water snappers to Hawaii caused another notable increase in bottomfish landings and revenues. Between 1982 and 1988, the botttomfish fishery comprised as much as 50% (by weight) of the total commercial landings. Beginning in 1988, the nature of American Samoa's fisheries changed dramatically with a shift in importance from bottomfish fishing towards trolling. In the past eight years, the dominant (by weight of fish landed) fishing method has been longlining.

During the early 1980's, fisheries data was collected from the bottomfish fishery by interviewing only commercial vessels. In the current Offshore Creel Survey on Tutuila that started on October 1, 1985, commercial, subsistence and recreational domestic fishing boats landing catch in five designated areas were interviewed and their catch recorded. For two weekdays and one weekend/holiday per week, DMWR technicians normally sampled offshore trips between 0500 and 2100 hours. In the past three years, the sampling period was increased to cover boats that come in earlier or after the normal sampling period. Two DMWR samplers based on Tau and Ofu collect fisheries data from the Manu'a islands fleet.

Boat-based fishing in American Samoa used to be mainly trolling and/or bottomfish. In the past six years, record longline landings were recorded with revenues around the one million-dollar mark. Bigger foreign boats are entering the local fisheries but these are rigged for longlining and more of these are expected to enter the territory's longline fishery. Limited entry options have been initiated to check this increase.

The bottomfish fishery of American Samoa was typically commercial overnight bottomfish handlining using skipjack as bait, on 28-30 foot aluminum/plywood Alias. Lower quality bottomfish imported from western Samoa helps satisfy the demand for bottomfish but at the same time result in unattractive prices for local bottomfish fishermen. The adverse effects of three hurricanes that struck American Samoa in 1987, 1990 and 1991 can be seen in some of the trends in the fishery as depicted by the data in this report.

Recent changes in the fishery and improvements in the Offshore Creel Survey necessitates modifications to algorithms used to process the data for this report. Hence the continuous improvements to DMWR's data processing systems by WPacFIN staff.

Recommendations

2000 Recommendation:

In consultation with the Central and local WPacFIN coordinators, the new Offshore Creel Survey supervisor should:

(i) Examine the unsatisfactory performance of the current samplers to ensure the necessary quality and integrity of sampled data.

(ii) Investigate if there are needed biological and stock assessment projects related to this fishery, i.e. the DMWR Oceanic Fishery Proposal.

(iii) Expand the fields in the offshore creel survey form for by-catch data collection as in Guam and train the samplers in a more focused approach for acquisition of by-catch information.

Status of 2000 Recommendations:

Improved performance by DMWR samplers have been observed with samplers asking for by-catch information. Future related projects will be formulated when a Chief Biologist is hired.

2001 Recommendations:

1. DMWR should start preparing a sampling program for the Alias fishing out of Vatia and Aunuu (not included in the normal sampling area) to improve coverage of the fisheries.

Table 1. American Samoa 2001 Estimated Total Bottomfish Landings by Species.

Interpretation: Changes in species composition of the bottomfish complex reported in the past are due to samplers' varying ability and commitment to the identification of the various bottomfish species. Historical and current data and observations however, do not indicate any major changes in the composition of the bottomfish species landed.

Source: DMWR Offshore Creel

Calculation: Catches are normally weighed by species either at landing sites or during the selling of fish to stores and restaurants. Trips missed by the Creel Survey are accounted for in a separate data collections system – the Commercial Invoice System. This analysis, as in the past, is for the Offshore Creel Survey catch only. Analysis of the bottomfish fishery presented in this report is for the whole bottomfish complex and **not just for the BMUS.**

Species	Pounds
Black snapper	42
Blacktail snapper	5
Blue lined gindai	60
Blue lined snapper	6051
Ehu (squirrelfish snap.)	4177
Gindai (flower snap)	226
Gray jobfish	2083
Hawaiian opakapaka	734
Humpback snapper	3714
Lehi (silverjaw)	1164
Onaga (longtail snapper)	4361
Onespot snapper	111
Pristipomoides/Etelis	150
Rufous snapper	7
Stone's snapper	338
Twinspot/red snapper	245
Yellow opakapaka	2435
Yelloweye opakapaka(P.fl.	138
Yellowtail snapper	540
Groupers (misc)	116
Blacktip grouper	101
Flagtail grouper	33
Lunartail grouper	1671
Peacock grouper	27
Smalltooth grouper	4
Tomato grouper	338
Emperors (misc)	10039
Bigeye emperor	117
Longnose emperor	556
Orangespot emperor	240
Redgill emperor	4784
Jacks (misc)	102
Bigeye trevally	1367
Black jack	1212
Total Bottomfish	**47285**

Table 2. American Samoa 2001 Estimated Commercial Landings by Species.

Species	Pounds	Price/Lb.	Value
Black snapper	42	$2.00	$83
Blue lined snapper	5783	$2.01	$11623
Ehu (squirrelfish snap.)	3135	$2.60	$8137
Gindai (flower snap)	226	$2.43	$549
Gray jobfish	1729	$2.00	$3465
Hawaiian opakapaka	343	$2.16	$739
Humpback snapper	3491	$2.00	$6982
Lehi (silverjaw)	829	$3.01	$2496
Onaga (longtail snapper)	3141	$1.87	$5876
Onespot snapper	87	$2.62	$227
Twinspot/red snapper	13	$2.00	$26
Yellow opakapaka	1612	$2.89	$4655
Yellowtail snapper	463	$2.50	$1158
Groupers (misc)	87	$2.00	$173
Blacktip grouper	28	$2.67	$75
Lunartail grouper	1459	$2.08	$3034
Peacock grouper	19	$2.00	$37
Tomato grouper	200	$2.11	$422
Emperors (misc)	9984	$2.00	$19994
Bigeye emperor	117	$2.00	$233
Longnose emperor	556	$2.00	$1112
Orangespot emperor	214	$2.00	$428
Redgill emperor	2418	$2.01	$4867
Jacks (misc)	16	$2.75	$43
Bigeye trevally	726	$2.20	$1597
Black jack	633	$1.83	$1161
Total Bottomfish	**37349**	**$2.12**	**$79193**

Interpretation: There appears to be no major changes in the prices of individual species in the past eight years. DMWR keeps track of fish prices for imported fish and those missed by the Offshore Creel Survey through a separate data collection system – the Commercial Invoice System. Data from that data processing system reveals that since 1992, the average price of bottomfish imported from western Samoa were lower than locally caught bottomfish. Locally caught bottomfish are of much superior quality than those imported from western Samoa (and previously from Tonga) because of better handling and affordable ice. Local fishermen, therefore, expect comparatively higher prices for their local bottomfish. Unfortunately, there has been a decrease in prices since 1998 and a 290% increase in miscellaneous fish exported from western Samoa this year.

Source: DMWR Offshore Creel Survey and Commercial Invoice System

Calculation: During creel surveys, the disposition of the catch is recorded, and if sold, the price is obtained whenever possible. The average prices reported in this table are calculated by dividing the total revenue by the weight sold in pounds for each species.

Table 3. American Samoa 2001 Bottomfish Bycatch

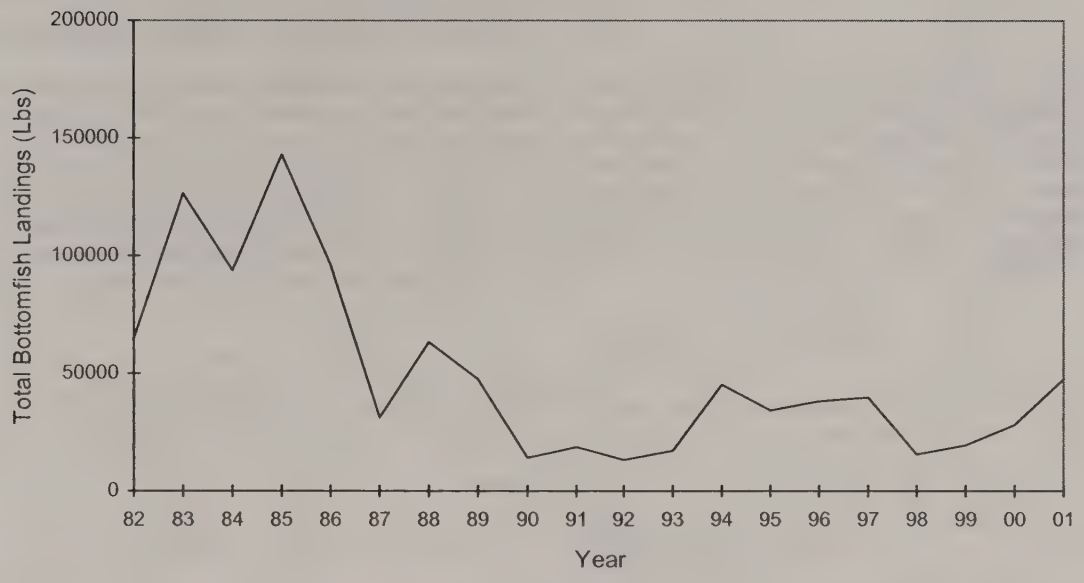
	Bycatch						Interviews		
Species	Alive	Dead Inj	Unk	Total	Catch	%BC	With BC	All	%BC
No Bycatch							0	449	0.00
All Species (Comparison)					6056	0.00			

Interpretation: No bycatch was recorded in the past two years

Source: DMWR Offshore Creel Survey

Calculation: The Bottomfish Bycatch table is obtained from creel survey interviews. The Bycatch numbers are obtained by counting fish in the interviews for purely bottomfishing trips with a disposition of bycatch. The catch for all species included for comparison is obtained by counting all species of fish caught by purely bottomfishing interviews and the number of interviews is a count of purely bottomfishing interviews

Figure 1. American Samoa Total Bottomfish Landings



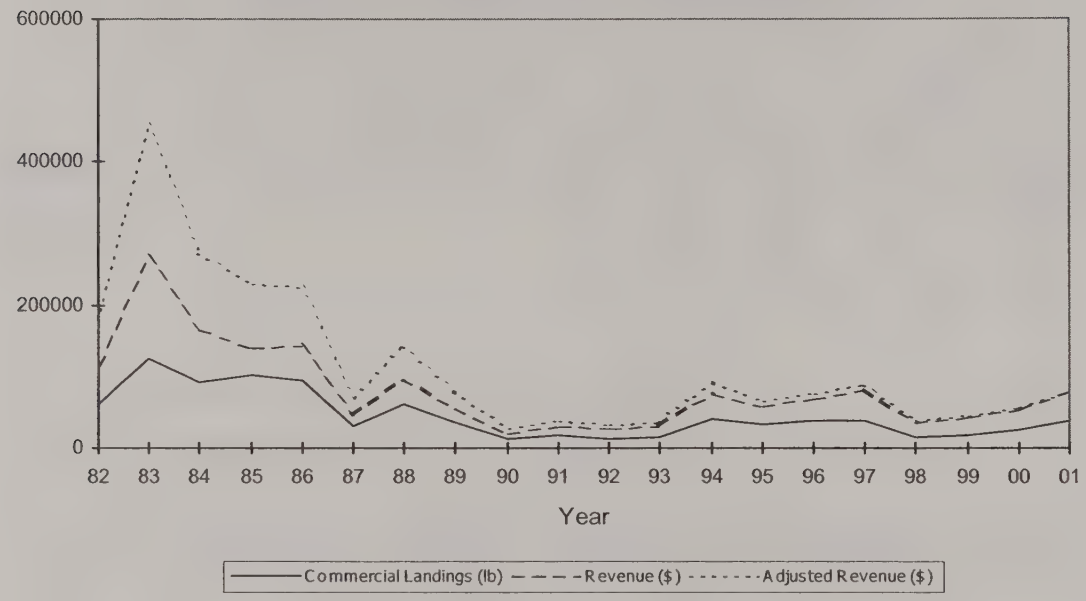
Interpretation: The substantial decline in landings in 1987 and 1990 were partially due to vessel losses caused by two hurricanes. Boat repairs were delayed as fisherman repaired or rebuilt their houses. In terms of total landings, the bottomfish fishery is much smaller in recent years than it was any time between 1982 and 1986, a period when there was a relatively large fleet and fishermen were attracted to the profitable bottomfish export program that exported deep-water snappers to Hawaii. The increase in 1994 was due primarily to improved sampling on Tutuila and increased efforts by the Tutuila highliners. Furthermore, the Manua landings more than tripled due to social/cultural events during the year. The 1998 decline mirror the 33% decrease in the number of boats participating. In the past two years some longline/troll fishermen have been bottomfishing when longline/troll catches and prices declined contributing to the 68% increase this year.

Year	Landings(lb)
1982	64942
1983	126327
1984	94104
1985	143225
1986	95978
1987	31148
1988	63237
1989	47482
1990	14303
1991	18677
1992	13316
1993	17518
1994	44982
1995	34414
1996	38522
1997	39863
1998	15862
1999	19563
2000	28068
2001	47285
Average	49941
Std. Dev.	36793

Source: DMWR Offshore Creel Survey Database

Calculation: Bottomfish landings for 1982-84 were calculated by adjusting the sampled Tutuila data by the calculated annual percent coverage of the fleet, and then adding the similarly adjusted Manu'a landings. The landings from 1986 to Present were calculated by expanding the Offsfore Creel Survey Data for Tutuila for the species listed in Table 1. The sampled Manu'a landings were adjusted by adjusting for the monthly perecent coverage of the fleet and added to the Tutuila data. Since the Offshore Creel Survey started in October 1, 1985, The first nine month of the 1985 landings were calculated as it was in 1982-84 and the last three months of the 1985 landings were calculated as it is now.

Figure 2. American Samoa Estimated Commercial Bottomfish Landings



Interpretation: Commercial landings mirror the total fishery's low catches in recent years compared to the robust 1982-1986 period. Relative to total landings, commercial landings decreased even more substantially in 1989, because the percent of the catch sold by bottomfish fishermen dropped from an average of about 97% in 1982-88 to 78% in 1989. The peak in 1983 portrays the high prices of deep-water snappers exported to Hawaii, while the trough in 1987 can be attributed to effects of the 1987 hurricane. The December 1991 hurricane contributed largely to the decreased landings and subsequently a decrease in revenues in 1992. Unfavorable weather continued through May 1992 hindering commercial bottomfish trips. Increased efforts in 1994 produced a notable increase in revenues and no major changes in commercial landings have been recorded since then. The observed increase in bottomfish

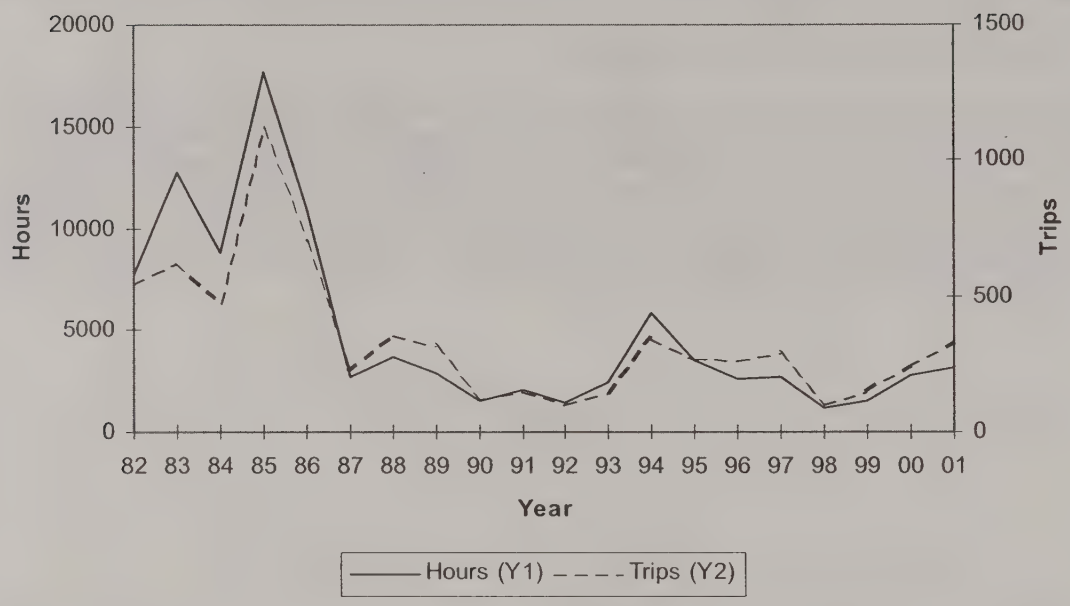
Year	Commercial Landings (lb)	Revenues	CPI	Adjusted Revenue
1982	62016	$113678	1.688	$191888
1983	125167	$269083	1.676	$450983
1984	92841	$166917	1.643	$274245
1985	102670	$141495	1.628	$230353
1986	95231	$142821	1.576	$225086
1987	30655	$46452	1.510	$70143
1988	60489	$97416	1.464	$142617
1989	36165	$55789	1.404	$78328
1990	12535	$20752	1.303	$27040
1991	17748	$29747	1.248	$37124
1992	13264	$27777	1.198	$33277
1993	15591	$30482	1.197	$36487
1994	41429	$77527	1.174	$91016
1995	33956	$58148	1.149	$66813
1996	37911	$69201	1.107	$76605
1997	38339	$82645	1.080	$89257
1998	14400	$35696	1.066	$38052
1999	17247	$42965	1.056	$45371
2000	26016	$54509	1.013	$55217
2001	37349	$79193	1.000	$79193
Average	45551	$82115		$116955
Std. Dev.	32707	$59119		$105102

participation is reflected in the continuous increase in landings (and consequently increases in revenues) since 1998.

Source: DMWR Offshore Creel Survey Database

Calculation: A relatively complex set of algorithms are used to estimate the commercial landings from estimates of total landings created by the creel survey data expansion system. In short the percent sold by species and by fishing method is calculated annually and multiplied by the estimated total landings by that method for that year. For 1982-85 sampling was conducted on the commercial fleet only (which included nearly all of the fishing boats), whereas since the 1985 creel sampling has covered all boats (commercial and recreational). Analysis of creel data for 1986-87 indicates that over 98% of the landed bottomfish was being sold. Therefore is it believed to be valid to compare commercial data for years prior to 1986 to creel survey totals for years since 1986.

Figure 3. American Samoa Estimated Bottomfish Hours and Trips



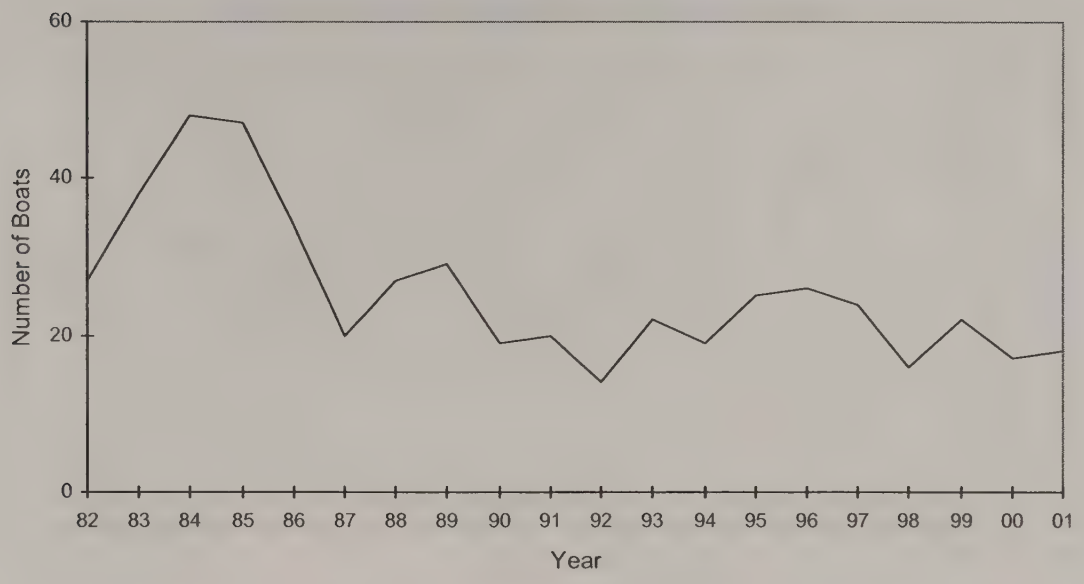
Interpretation: The sharp decline in the bottomfish landings since 1986, noted in Fig.1 is mirrored in this figure by a sharp decline in the level of effort expended in that fishery. Rather than indicating a problem with the resource , this decline depicts an actual trend of commercial boat owners and fishermen seeking other more lucrative and stable lines of work. The 1994-1996 estimated efforts were greater than those for the 1990-93 period due to the highliners increased efforts, with some boat owners employing teams (usually 2-3 fishermen) in continuous shifts during good weather. In 1997 and 1998 the number of boats participating in this fishery dropped significantly (see Figure 4) resulting in the notable declines in the number of trips and hours fished that period. The 1999 increase in effort can be attributed to some Alias that normally longline and troll, doing occasional bottomfishing. A couple of Alias engaged in similar activities this year with the bottomfishing Alias fishing shorter (18%decrease in hrs/trip) trips.

Year	Hours	Trips
1982	7671	548
1983	12695	621
1984	8796	468
1985	17682	1116
1986	10963	698
1987	2654	222
1988	3660	354
1989	2844	313
1990	1548	122
1991	2042	145
1992	1426	101
1993	2393	141
1994	5857	341
1995	3497	270
1996	2608	265
1997	2712	290
1998	1132	100
1999	1519	145
2000	2755	242
2001	3104	331
Average	4878	342
Std. Dev.	4351	243

Source: DMWR Offshore Creel Survey Database

Calculation: The annual estimated hours spent bottomfishing is calculated by dividing the annual total bottomfish catch by the average CPUE (pounds per hour) from trips doing only bottomfish fishing. The annual estimated number of trips is calculated by dividing the estimated annual hours by the average length of a bottomfish fishing trip. The average length of a bottomfish fishing trip (not shown) is calculated by using only trips which exclusively bottomfished and for which the trip length was recorded. The total hours fished from those trips is then divided by the number of trips. Recorded hours are trip hours.

Figure 4. American Samoa Annual Estimated Number of Boats Landing Bottomfish



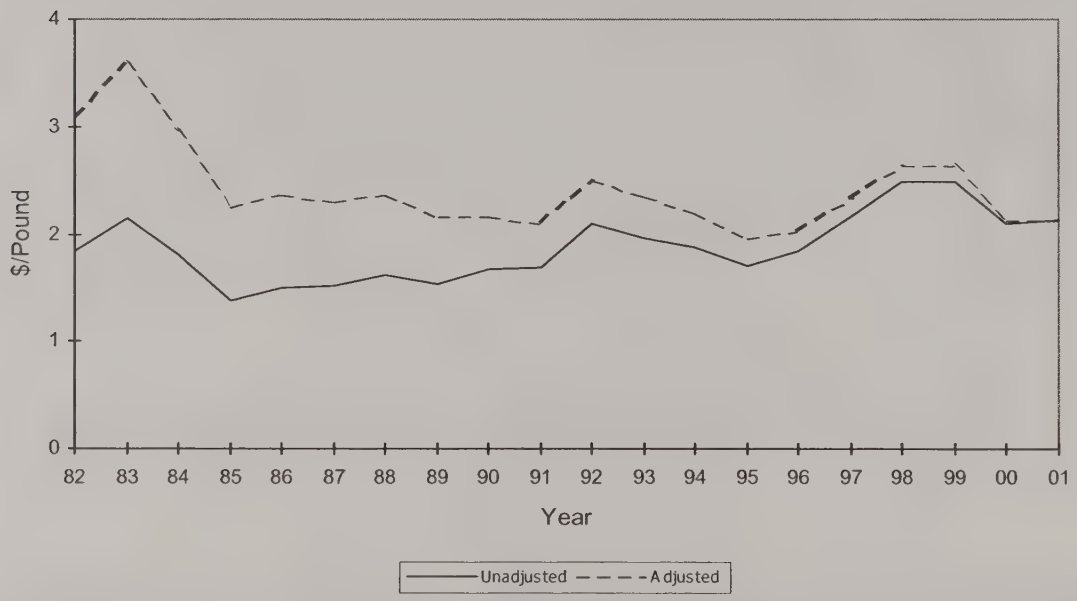
Interpretation: The decline in the fishery since 1985-86 is reflected by a decline in the number of boats participating in it. The 1987 hurricane caused the loss of the whole Manu'a fleet, plus some of the Tutuila fleet. Several Boats that contributed to the 1989 bottomfish annual landings did not land any bottomfish in 1990, due to much needed boat repairs and their participation in non-bottomfish chartered trips. About 90% of the domestic fishing fleet was affected by the December 1991 hurricane, hence the slight decline in 1992. The increase in 1993 is due mainly to the re-entry to this fishery of a few boats after repairs, trips by two 14-foot vessels that didn't bottomfish in 1992, and the entry of one new Alia into the sampling area. A few new Alias were bought from western Samoa and entered the fishery in 1995-1996. The continued increase in the number of bottomfish Alias electing to longline, attracted by the relatively higher revenues obtained mainly from albacore sold to the canneries, is reflected in the significant drop in the number of boats bottomfishing in 1998. A few more Alias contributed to the landings in 1999 with no noticeable changes since then.

Source: DMWR Offshore Creel Survey database

Calculation: The annual estimate of the number of boats in the bottomfish fishery is obtained from the data base by counting the unique boats sampled during the year which landed any bottomfish species regardless of fishing method.

Year	Boats
1982	27
1983	38
1984	48
1985	47
1986	34
1987	20
1988	27
1989	29
1990	19
1991	20
1992	14
1993	22
1994	19
1995	25
1996	26
1997	24
1998	16
1999	22
2000	17
2001	18
Average	26
Std. Dev.	9

Figure 5. American Samoa Average Price of Bottomfish



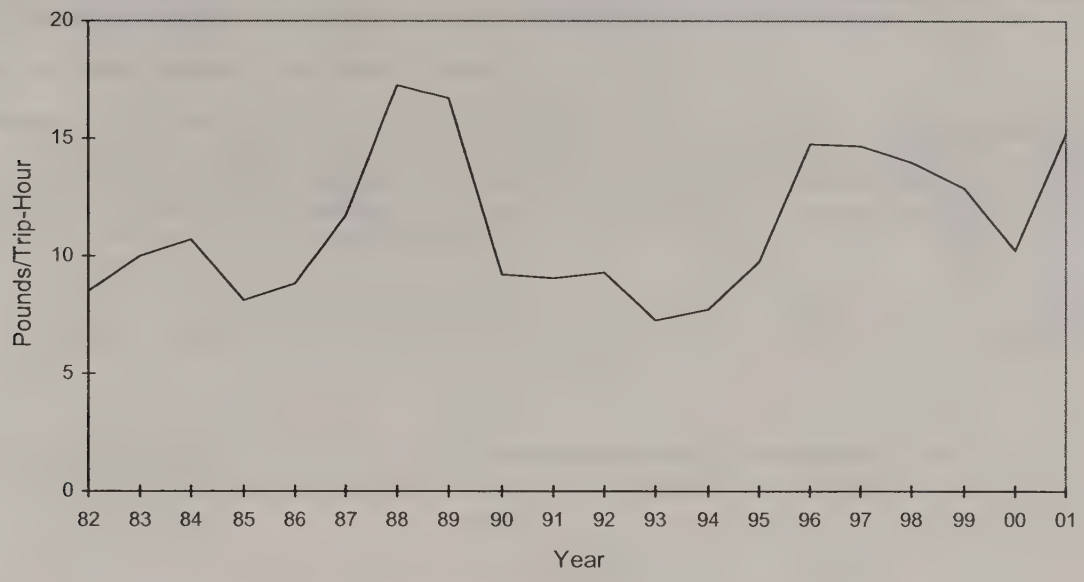
Interpretation: Prices were generally higher between 1982 and 1984 during the exportation of high-priced deepwater snappers to Hawaii. After this period, inflation-adjusted local prices have generally been stable. Prices of locally caught bottomfish are generally higher than imported fish, and could have been even higher had the local markets not been flooded by imported fish, which are usually of lower quality. The only imported bottomfish in 1994 were from western Samoa and these were sold at an average price of $1.67/lb. Imported bottomfish (mainly from western Samoa) have always helped in meeting the demand for bottomfish. The increase in average price in 1998 is attributed mainly to the increase in demand for fresh bottomfish by a few new restaurants. Since 1999 there has been a general increase (16% in 1999 and 290% this year) in pounds of fish (miscellaneous bottomfish and pelagics) imported from western Samoa and may contribute (increase supply) to last year's price drop. A relatively unchanged price/lb was recorded for this year.

Year	Unadjusted Price/Lb	Adjusted Price/Lb
1982	$1.83	$3.09
1983	$2.15	$3.60
1984	$1.80	$2.96
1985	$1.38	$2.25
1986	$1.50	$2.36
1987	$1.52	$2.30
1988	$1.61	$2.36
1989	$1.54	$2.16
1990	$1.66	$2.16
1991	$1.68	$2.10
1992	$2.09	$2.50
1993	$1.96	$2.35
1994	$1.87	$2.20
1995	$1.71	$1.96
1996	$1.83	$2.03
1997	$2.16	$2.33
1998	$2.48	$2.64
1999	$2.49	$2.63
2000	$2.10	$2.13
2001	$2.12	$2.12
Average	$1.87	$2.41
Std. Dev.	$0.31	$0.40

Source: DMWR Offshore Creel Survey database

Calculation: The average price of all bottomfish species combined is calculated by dividing total bottomfish revenue by total sold weight. The inflation-adjusted price is calculated by multiplying the unadjusted annual average price by the annual calculated consumer price index (CPI) for American Samoa using the current year as base.

Figure 6. American Samoa Annual Bottomfish CPUE



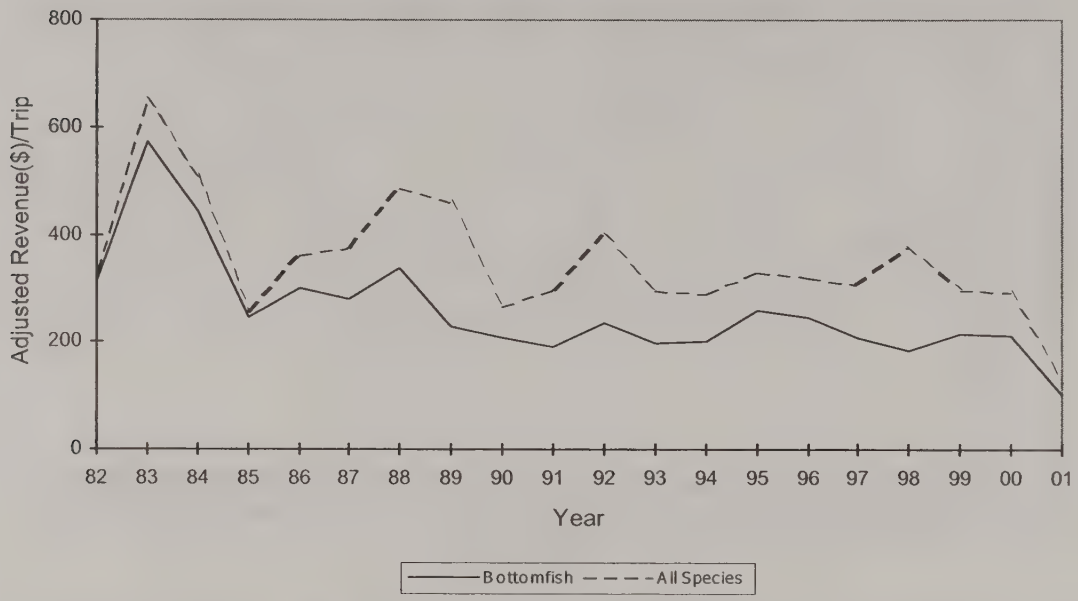
Interpretation: The initial increased CPUE in 1983 and 1984 occurred during the intense fishing of some new fishing grounds for deepwater snappers for export to Hawaii. A relatively high number of boats and local fishermen participated in the fishery during this period. The decline in 1985 and 1986 might be expected following the ardent harvesting of the limited fishing grounds. Reasons for the CPUE peak in 1988-89 are unknown. The decline in CPUE from 1989 to 1991 can be partially attributed to a combination of some new inexperienced fishermen entering the fishery and the exit of experienced and full-time commercial fishermen. CPUE has essentially remained stable during 1990-1992, increased for a few years and was relatively stable in 1996-1998. Bottomfishing techniques and gear have generally remained the same in the past years with the Alias being the highliners since the early 1970's. The 1996 high CPUE estimates (and most probably the 1988-89 CPUE increase) can be attributed mainly to improved sampling and may also be related to favorable environmental conditions. This also maybe representing cyclical trends that maybe caused by decadal and inter-annual climatic changes with similar trends shown in the Hawaii bottomfish fishery. The past five year's CPUE was not less than 50% of the average aggregate CPUE for the first three years of available data and this years CPUE is the highest since 1990

Source: DMWR Offshore Creel Survey database

Calculation: CPUE is calculated using only trips in which only the bottomfish method was used and trip hours were recorded. The average is calculated by using each CPUE from each trip as an observation and dividing by the number of trips.

Year	CPUE
1982	8.50
1983	10.00
1984	10.70
1985	8.10
1986	8.80
1987	11.70
1988	17.30
1989	16.70
1990	9.20
1991	9.10
1992	9.30
1993	7.30
1994	7.70
1995	9.80
1996	14.80
1997	14.70
1998	14.00
1999	12.90
2000	10.20
2001	15.20
Average	11.30
Std. Dev.	3.05

Figure 7. American Samoa Average Inflation-Adjusted Revenue Per Trip Landing Bottomfish.



Interpretation: There have been no notable changes in revenues since 1990. The distance between these two lines reflects the relative importance of bottomfish species in the total catch whenever any bottomfish are landed. The prominent importance of bottomfish between 1982 and 1985 occurred during the targeting of deepwater snappers (mainly ***Etelis*** and ***Prisitipomoides***) for export to Hawaii. Bottomfish fishing was also the more profitable method of fishing during that period. The relative importance of bottomfish has generally been declining since 1985 as most of the full-time commercial fishermen quit this fishery with the remaining opting for trolling and lately, longlining. The supply of locally caught bottomfish has been supplemented by bottomfish imported from western Samoa.

Year	Bottomfish Unadjusted	Bottomfish Adjusted	All Species Unadjusted	All Species Adjusted
1982	$185	$312	$196	$330
1983	$341	$572	$388	$651
1984	$269	$441	$309	$508
1985	$151	$246	$157	$255
1986	$189	$298	$229	$362
1987	$184	$278	$249	$376
1988	$231	$338	$332	$486
1989	$163	$229	$327	$458
1990	$160	$209	$205	$267
1991	$151	$189	$237	$296
1992	$196	$235	$332	$397
1993	$165	$197	$246	$295
1994	$171	$201	$245	$288
1995	$227	$260	$288	$331
1996	$221	$244	$290	$321
1997	$190	$206	$283	$306
1998	$172	$184	$355	$378
1999	$204	$215	$281	$297
2000	$208	$211	$290	$294
2001	$102	$102	$127	$127
Average	$194	$258	$268	$351
Std. Dev.	$48	$99	$64	$108

The effects of the low price/lb recorded this year and the 290% increase in imported (from western Samoa) miscellaneous fish partially explains the decline in revenues per trip for this year.

Source: DMWR Offshore Creel Survey database

Calculation: The average revenue per trip for all species is calculated by summing the revenues of all sales for any trip which landed any bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trip is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips. Figure 7 plots the inflation-adjusted bottomfish and all species revenue per trip for the period 1982-2001.

Appendix 2

Guam

CONTENTS

1. Summary 2-2

2. Historical Annual Statistics 2-3

3. Introduction 2-4

4. Recommendations 2-6

5. List of Tables 2-7

6. List of Figures 2-7

Summary

The new offshore creel survey expansion system utilizes a database format to expand the offshore survey data. The new format separates the charter and non-charter components, allows for the distinction between the shallow and deep bottomfish complexes, and provides for the collection of bycatch data. This improvement, combined with the addition of the Merizo boat ramp in 1991 and the Agat Marina in 1994 as offshore sampling ports, and recent revisions of expansion algorithms have contributed to the increased efficiency in the production and reliability of the Guam annual reports. This has become important in recent years as overall fish stocks appear to be declining and management decisions are being made based on data that is collected. Although complemental statistics of confidence and analysis of biological and species composition data are not possible at this time, Guam's Department of Agriculture's Fisheries Section is continuing work with the WPacFIN program coordinator to further develop the expansion system to eventually include production of such analyses. Work is currently being done to integrate the inshore creel census data with the offshore creel census data in order to obtain a better idea of BMUS species recorded by both data collection entities of DAWR's Fisheries section.

The bottomfish fishery data in 1998 indicated that Guam's aggregate CPUE for all bottomfishing may have been in a "yellow light" condition, an indicator of fishery stress. However, the charter and non-charter components were expanded separately in 1999 and a "yellow light" condition was not observed with the non-charter component. The bottomfish charters, primarily the Agat Marina bottomfish charters, may have skewed the overall CPUE toward a "yellow light" condition due to the high effort and low catch of this component of bottomfishing. Nonetheless, anecdotal evidence from local fishermen and creel census data do show that the bottomfish fishery is stressed. The sizes of bottomfish are decreasing, especially those of the shallow water complex. Unfortunately, these fish are usually not released despite their small size, although more fishermen are practicing release of small fish and less desirable species.

Total and BMUS bottomfish harvest decreased in 2001, except for the charter component of the total bottomfish harvest. Total bottomfish landings decreased 17%, with the non-charter and charter components decreasing 18% and increasing 45% respectively. Total BMUS landings decreased 13%, with the non-charter and charter components decreasing 15% and 8% respectively. The non-charter component makes up 98% of the total bottomfish and BMUS harvest. The CPUE for all bottomfish increased slightly, 3%, while the non-charter CPUE remaining the same. The charter CPUE increased 23%.

The commercial sale of BMUS species increased 16% in 2001, with the adjusted revenue increased 10%. The number of boats bottomfishing, the number of bottomfish trips, and the number of hours spent bottomfishing in 2001 increased 8%, 9%, and 3% respectively.

Historical Annual Statistics

Year	Total Bottomfish Landings (lbs)	CPUE (lbs/hour)	CPI	Adjusted Revenue ($)	Adjusted Price/lb ($)	Number of Boats
80			134.0	42,966	4.55	
81			161.4	58,245	5.50	
82	40,080	7.2	169.7	39,471	5.68	154
83	46,976	6.3	175.6	190,585	5.15	106
84	57,197	7.3	190.9	189,265	4.97	144
85	86,134	5.7	198.3	184,917	4.70	161
86	36,441	5.2	203.7	64,288	4.42	118
87	45,034	5.8	212.7	55,298	4.38	139
88	67,773	4.9	223.8	66,524	4.18	198
89	84,016	5.6	248.2	95,299	4.85	223
90	74,718	4.5	283.5	88,944	4.70	226
91	69,985	4.8	312.5	50,662	4.49	246
92	85,657	5.8	344.2	44,045	4.13	236
93	95,887	4.2	372.9	39,536	3.88	360
94	107,512	5.6	436.0	120,369	3.97	298
95	106,561	2.5	459.2	48,813	3.53	402
96	151,444	4.1	482.0	18,885	2.74	408
97	103,707	3.7	489.7	32,115	3.02	332
98	97,187	2.6	487.1	48,964	3.32	354
99	128,008	3.2	496.0	110,837	3.60	411
00	146,481	3.7	505.9	81,246	3.49	312
01	**121,427**	**3.8**	**499.4**	**89,844**	**3.28**	**337**
Average		4.5	322.12	80,051	4.26	258
Std. dev.		1.1	136.38	50,920	0.81	102

Introduction

There are two distinct bottomfish fisheries on Guam that can be separated by depth and species composition. The shallow water complex (<500 feet) makes up a larger portion of the total bottomfish effort and harvest, comprised primarily of reef-dwelling snappers, groupers, and jacks of the genera *Lutjanus*, *Lethrinus*, *Aprion*, *Epinephelus*, *Variola*, *Cephalopholis* and *Caranx*. The deepwater complex (>500 feet) consists primarily of groupers and snappers of the genera *Pristipomoides*, *Etelis*, *Aphareus*, *Epinephelus*, and *Cephalopholis*.

Bottomfishing on Guam is a combination of recreational, subsistence, and small-scale commercial fishing. This fishery can be highly seasonal in that effort significantly increases when sea conditions are generally calmer during the summer months, although calm sea conditions can occur every month of the year. During these periods, fishing activity increases dramatically on the east side of the island, a more productive fishing area. The majority of people in this fishery are either subsistence or part-time recreational fishermen that operate vessels less than 25 feet in length, target primarily the shallow water bottomfish complex and combine some trolling effort to supplement their bottomfishing effort.

The Agana Boat Basin is centrally located on the western leeward coast and serves as the island's primary launch site for boats fishing areas off the central and northern leeward coasts and the northern banks. Most commercial trolling activity operates out of this site. The Merizo boat ramp, Seaplane Ramp in Apra Harbor, Umatac boat ramp, and Agat Marina are boat launch sites which provide access to the southern coast, Apra Harbor, Cocos Lagoon, and the southern banks. The Agat Marina, located between the Agana Boat Basin and the Merizo boat ramp, provides trailered boats from the northern and central areas of the island a closer and more convenient launch site to the southern fishing grounds. A makeshift ramp at Ylig Bay provides access to fishing areas on the eastern side of the island, and is heavily used during periods of calm weather. Surveying this part of the island, specifically the Ylig makeshift ramp, during the summer months has been proposed since this area may harvest significant quantities of BMUS species, either by Bottomfishing or spearfishing. However, a lack of adequate lighting and other safety issues make surveying this area challenging. At present, Department of Agriculture's Fisheries Section conducts its offshore creel surveys at the Agana Boat Basin, the Agat Marina, and the Merizo boat ramp.

A significant addition to bottomfishing activity effort in recent years is the charter fishing boats that can make several two to four hour trips daily. These charter vessels range from typical trolling charter boat with patrons who opt to Bottomfish, to larger bottomfishing-only vessels that can accommodate as many as 35 patrons per trip. The larger vessels tend to fish in the same general area and release most of their catch, which have become primarily small triggerfish, groupers, and goatfish. These boats will have been known to keep larger fish and use a portion of the smaller catch to serve as sashimi for their guests. This sector, primarily the Agat charters, has been experiencing a decline in the number of trips and guests as a result of declining tourists from Asia. Fishing continuously in the same area has brought about a virtual absence of large fish that their guests can catch. The practice of other fishing methods in the same area in Agat, such as gillnetting and spearfishing, also occur in the same area. This may also contribute to the types and sizes of fish caught.

In 2001, the U.S. Navy began testing for PCBs around the Orote peninsula, located south of Apra Harbor. Preliminary testing of several fish species showed that a few fish had high levels of PCB. A warning about PCB contaminated fish has been issued for all marine foodfish and invertebrates caught from Orote to Agat. A decline in fishing around Orote may have decreased fishing activity in that area, but may have also

increased fishing in other areas. The final results of the PCB testing should be completed in 2002.

Agriculture's Fisheries Section began collecting information on bycatch as part of its offshore creel census at the beginning of 2000 as a requirement of the bottomfish FMP. This will provide information on the effect bottomfishing may have on fish species that are caught but discarded, a practice observed quite frequently with the charter sector, and beginning to be observed with the non-charter sector. The release of small fish back into the marine environment is a small but significant action taken by some fishermen as a response to declining numbers and smaller sizes of preferred food fish.

The demand for both deep and shallow-water bottomfish continues to exceed the locally-caught supply. Although Guam's deepwater bottomfish fishery has limited economic importance, especially in the absence of highliner vessels, the cultural value of the shallow water complex remains high due to the popularity of this assemblage of fish as food items. Some of the demand for bottomfish is offset with imports from the Philippines and Micronesia. This demand, however, may be contributing to the overall decline in nearshore and reef-associated bottomfish populations.

In 2000, Guam began enforcing fishing activity in five marine preserves that were established in 1997. These preserves were established due to an overall decline in the numbers and sizes of nearshore fisheries surveyed by DAWR's inshore fishery program. While three preserves are strictly no-take areas, two preserves, the Pati Point and Tumon Bay preserves, allow limited fishing. These preserves also include no fishing up to 200 meters beyond the reef, restricting shallow water bottomfishing. These preserves appear to be working, as information from fishermen fishing in adjacent areas and from divers have observed more fish and larger fish. However, a lack of consistent enforcement has not eliminated fishing in these areas, especially boat-based fishing methods that include bottomfishing. Effective enforcement, which relies heavily on local funding, is necessary in order to allow near shore and reef-associated bottomfishing stocks to recover. BMUS species such as the larger groupers and snappers, which have been heavily impacted by fishing, may have a difficult time recovering as a result of a lack of effective enforcement and an increase in boat-based fishing activity.

Recommendations

Status of 2000 recommendations

1. Integrating the offshore and inshore creel census data and the fine-tuning of the offshore expansion program is ongoing. Invaluable technical assistance from NMFS has enabled DAWR to move closer towards providing statistics of confidence, and analysis of mean fish size, and separation between the shallow and deepwater bottomfish complexes. Inputting the remaining historical offshore data that should have been completed in 2001 is still ongoing. The loss of three fisheries staff during 2001 and an increase in other fisheries projects has delayed this recommendation from being completed during 2001.

2. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. The loss of fisheries staff during 2000 and an increase in other fisheries projects have prevented the Ataloa bottomfishing data from being analyzed.

3. The establishment of mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes has not been completed during 2001, although the offshore expansion program is being fine-tuned and integration of the offshore and inshore creel survey data has began. Guam's offshore coordinator and NMFS Honolulu lab staff continues to make progress towards completing this recommendation.

2001 Recommendations

1. Integrating the offshore and inshore creel census data and the fine-tuning of the offshore expansion program is ongoing. Invaluable technical assistance from NMFS has enabled DAWR to move closer towards providing statistics of confidence, mean fish size, and separating the shallow and deepwater complexes. Inputting the remaining five years of offshore data should be completed in 2002, although the loss of staff and an increase in fisheries projects have made completion of this recommendation slow.

2. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. DAWR's fisheries staff has discussed making progress towards completing this study during 2002.

3. With additional funding from the WPacFIN program and technical assistance from NMFS, Guam's DAWR should establish mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes.

Tables

Page

1. Guam 2001 expanded creel survey composition of bottomfish management unit species (BMUS).....2-8

2. Guam 2001 commercial bottomfish average prices.....2-8

Figures and Tables

Page

1a. Guam harvest of all bottomfish species.....2-9
b. Guam harvest of BMUS species.....2-9

2a. Total and Commercial BMUS harvest.....2-12
b. Commercial BMUS revenue.....2-12

3a. Estimated bottomfish boat hours.....2-15
b. Estimated bottomfish trips.....2-15

4. Guam bottomfish fishery participation.....2-17

5. Average bottomfish prices.....2-19

6. Guam bottomfish CPUE.....2-21

7. Guam average revenue per trip.....2-23

8a. Jacks/Trevallys: Harvest.....2-25
b. Jacks/Trevallys: CPUE.....2-25

9a. Snappers: Harvest.....2-27
b. Snappers: CPUE.....2-27

10a. Groupers: Harvest.....2-29
b. Groupers: CPUE.....2-29

11a. Emperors: Harvest.....2-31
b. Emperors: CPUE.....2-31

12a. Guam 2001 Bottomfishery Bycatch: Non-charter.....2-33
b. Guam 2001 Bottomfishery Bycatch: Charter.....2-33
c. Guam 2001 Bottomfishery Bycatch: Summary.....2-34

Table 1. Guam 2001 Expanded Offshore Creel Survey Composition Of Bottomfish Management Unit Species (BMUS)

Management Unit Species	Total Harvest*(lbs)
Lehi (*A. rutilans*)	1,311
Uku (*A. virescens*)	2,182
Ehu (*E. carbunculus*)	5,450
Onaga (*E. coruscans*)	2,905
Yellowtail Kalekale (*P. auricilla*)	4,209
Opakapaka (*P. filamentosus*)	1,838
Yelloweye Opakapaka (*P. flavipinnis*)	354
Gindai (*P. zonatus*)	6,491
Ta'ape (*L. kasmira*)	2,169
Other Snappers	5,987
Jacks (*C. ignobilis, C. lugubris*)	2,757
Amberjack (*S. dumerili*)	849
Other Jacks	15,671
Groupers (*C. urodeta, E. fasciatus, V. louti*)	5,238
Other Groupers	10,014
Emperors (*L. rubrioperculatus*)	13,690
Other Emperors	35,271
Total	**116,386**

*Bottomfishing method only

Table 2. Guam 2001 Commercial Bottomfish Average Prices

Species	Average $/lb
Amberjack	2.70
Ehu	3.99
Kalekale	3.39
Lehi	4.00
Onaga	4.29
Opakapaka	4.00
Uku	3.27
Gindai	3.99
Black Jack	2.57
Misc. Jacks	2.47
Groupers	2.41
Emperors	3.10
Snappers	2.63
Misc. Deep Bottomfish	3.71
Misc. Bottomfish	2.96
All Bottomfish Species	**3.53**

Figure 1a. Guam Harvest of All Bottomfish Species

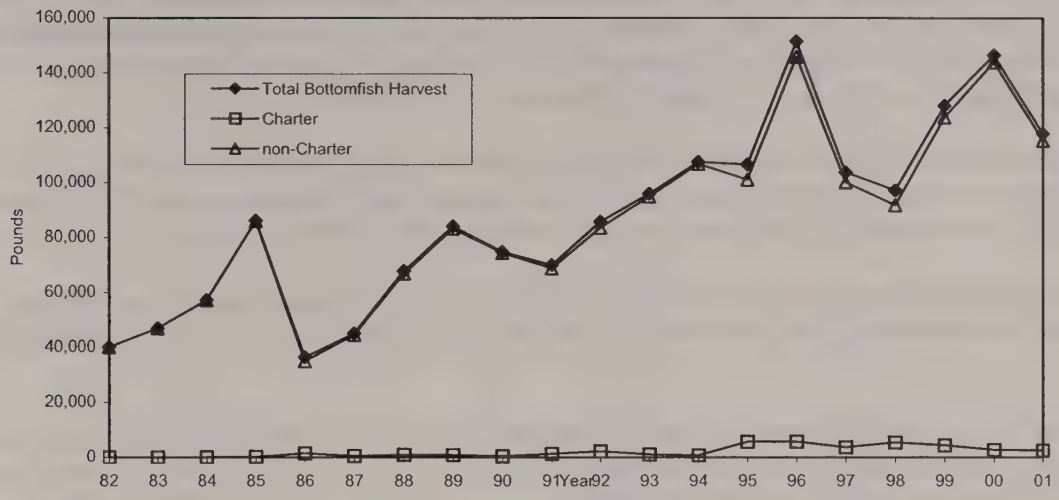
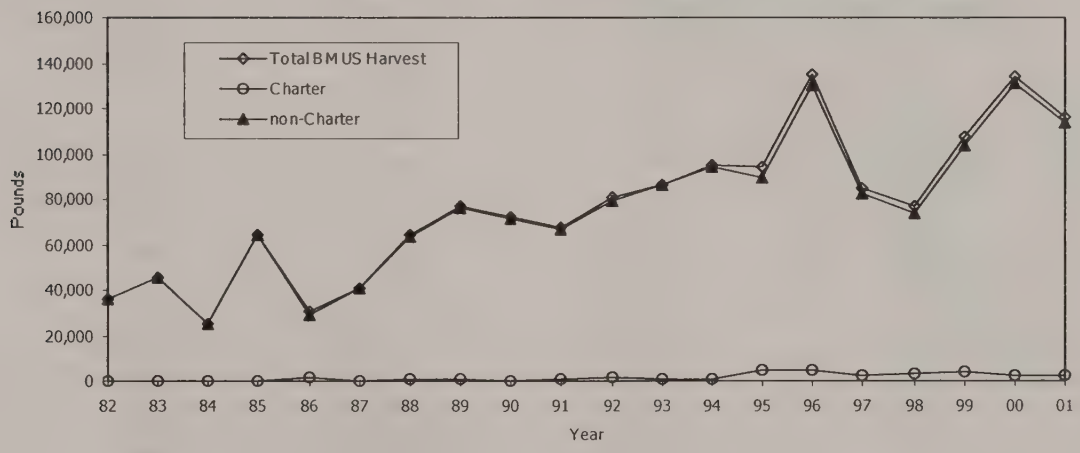


Figure 1b. Guam Harvest of BMUS Species



Interpretations: Historically, annual fluctuations of BMUS landings were usually due to highliners entering or leaving the fishery during a given year. The peak in 1985 of BMUS species harvested was the result of a

number of highliner fishermen who fished in 1985 and then left the fishery the following year. The decrease in the "all bottomfish" category observed in 1997 may have been caused by the elimination of the bigeye scad or atulai, *Selar crumenopthalmus*, as part of the bottomfish catch in the 1997 expansion. The inclusion of this fish in previous bottomfish expansions, especially during a bumper harvest year such as 1996, likely had the effect of inflating bottomfish catch totals. Distinguishing the difference between methods used to catch the bigeye scad continues to be an ongoing challenge, since some fishermen have reported that bottomfishing is the method used to capture these fish. Training DAWR's offshore survey staff is ongoing in order to collect accurate data from fishermen to distinguish between the two methods.

In 2001, a decrease in bottomfish and BMUS harvest was observed. Total bottomfish decreased 17%, with the non-charter and charter sectors decreasing 18% and increased 45% respectively. BMUS harvest decreased 13%, with non-charter and charter sectors decreasing 15% and 8% respectively.

Source: The DAWR offshore creel survey data as expanded by computer-based algorithms by method of fishing. All unidentified catch was allocated to species categories based on the species percentage of the total catch.

Calculations: The estimated total landings of the bottomfish species are selected from the expanded creel survey species composition files. However, the expanded estimates of catch by species must include at least a portion of the catch identified only by generic species codes categories. These generic categories (e.g. assorted/shallow/deep bottomfish) also include some non-BMUS bottomfish according to the FMP definition (e.g. triggerfish, wrasses, goatfish).

Year	Total Bottomfish Harvest (lbs)	Non-charter Harvest (lbs)	Charter Harvest (lbs)
82	40,008	40,060	20
83	46,976	46,976	0
84	57,197	57,197	0
85	86,134	85,946	188
86	36,441	34,966	1,475
87	45,034	44,576	458
88	67,773	66,842	931
89	84,016	83,168	848
90	74,718	74,334	384
91	69,985	68,739	1,246
92	85,657	83,476	2,181
93	95,887	94,838	1,049
94	107,512	106,757	755
95	106,561	100,980	5,581
96	151,444	145,769	5,674
97	103,707	100,099	3,607
98	97,187	91,745	5,442
99	128,008	123,678	4,330
00	146,481	143,808	2,673
01	**121,427**	**117,557**	**3,870**
Average	94,369	92,057	2,312
Std. deviation	31,423	30,277	1,925

Year	Total BMUS Harvest (lbs)	Non-charter BMUS Harvest (lbs)	Charter BMUS Harvest (lbs)
82	36,449	36,429	20
83	45,609	45,609	0
84	24,884	24,884	0
85	64,696	64,508	188
86	30,411	28,936	1,475
87	40,722	40,410	311
88	64,696	63,764	931
89	76,678	75,831	848
90	71,791	71,437	354
91	67,358	64,464	894
92	80,826	79,287	1,539
93	86,595	85,930	665
94	94,886	94,316	570
95	93,875	89,392	4,483
96	134,624	129,819	4,805
97	84,946	82,381	2,565
98	76,580	73,412	3,168
99	107,537	103,400	4,137
00	133,984	131,311	2,673
01	**116,386**	**113,904**	**2,482**
Average	76,677	75,071	1,600
Std. deviation	31,689	30,587	1,570

Figure 2a. Total and Commercial BMUS Harvest

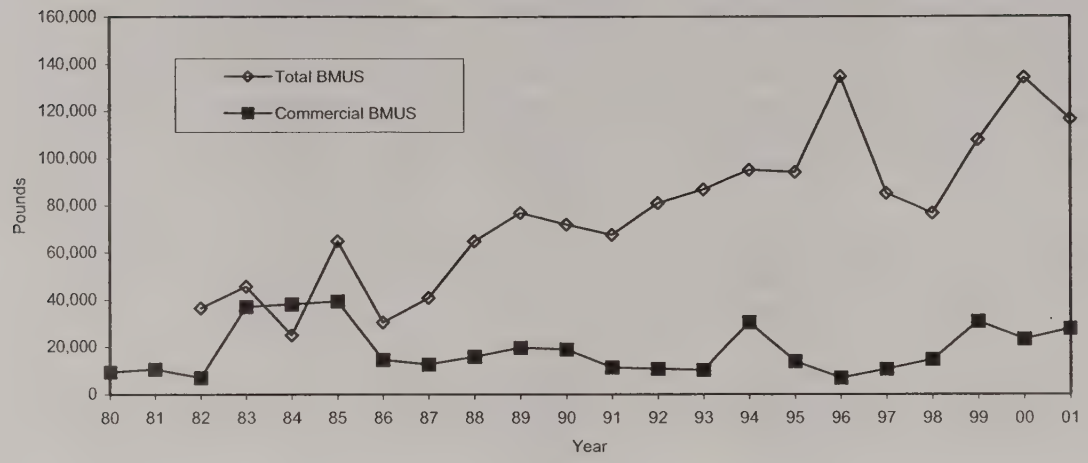
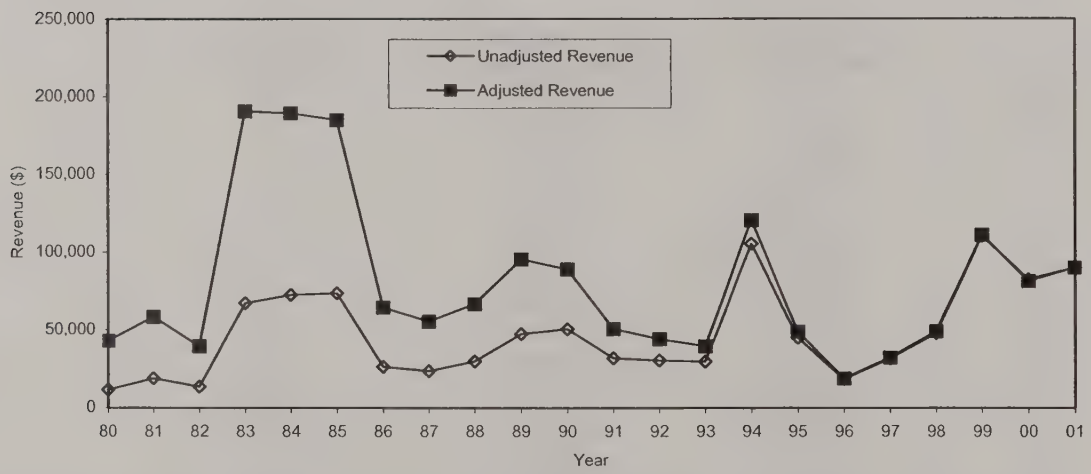


Figure 2b. Commercial BMUS Revenue



Interpretations: Highliners have generally been responsible for the peaks in the commercial BMUS landings, as was the case in 1983, 1985, 1994, 1998, and 1999. The threefold increase in 1994 of the commercial BMUS harvest and revenue was the result of highliner vessels entering into the fishery that year. The 39% reduction in BMUS harvest and 56% decline in commercial harvest for 1995 are best explained by the absence or reduced effort of about six highliners who combined, have landed an average of 18% of the total BMUS harvests between 1992 and 1996, and 68% of the unexpanded commercial landings for the same period. Harvest records for these six highliners indicate a 45% reduction in 1995 of their total bottomfish harvest, dropping from 13,349 pounds in 1994, down to 6,023 pounds in 1995. This decline in highliner landings accounts for about two-thirds of the 1995 reduction in commercial BMUS harvest.

The peak in 1996 followed by a 46% decline the following year in total BMUS harvest is believed to have been influenced more by weather conditions than any other factor. In 1997, storms decreased the number of calm fishing days. Favorable weather conditions were also observed during 2001.

In 1996, the commercial BMUS harvest and adjusted revenue dropped to its lowest point ever, partially due to almost a complete absence of highliner activity that year. The slight increase in 1997 is attributed to a single highliner making several recorded trips to "Bank A," a rarely fished bank located 117 miles west of Guam. The increase in 1999 is likely the result of several highliners in the fishery, as well as an overall increase in participation and effort. A 10% increase in revenue was observed in 2001.

Source: The estimated total landings are from the DAWR creel survey system, and the commercial data are from the WPacFIN-originated commercial landings system.

Calculations: The total commercial bottomfish landings and revenue for each year were calculated by summing the weight and value fields in the commercial landings database and then multiplying by an estimated percent coverage expansion factor. This annual expansion factor was subjectively created and includes an analysis of the "disposition of catch" data available from the DAWR offshore creel survey, an evaluation of the fishermen in the fishery and their entry and exit patterns, general dockside knowledge of the fishery, status of marketing conditions and its structure, overall number of records in the data base, and a measure of best educated guesses.

Year	Total BMUS Harvest (lbs)	Commercial BMUS Harvest (lbs)	Unadjusted Revenue ($)	Adjusted Revenue ($)
80		9,434	11,528	42,966
81		10,596	18,825	58,245
82	36,449	6,947	13,412	39,471
83	45,609	36,984	67,013	190,585
84	24,884	38,113	72,349	189,265
85	64,696	39,327	73,438	184,917
86	30,411	14,532	26,219	64,288
87	40,722	12,639	23,551	55,298
88	64,696	15,933	29,818	66,524
89	76,678	19,630	47,365	95,299
90	71,791	18,916	50,479	88,944
91	67,358	11,278	31,703	50,662
92	80,826	10,668	30,355	44,045
93	86,595	10,191	29,526	39,536
94	94,886	30,356	105,126	120,369
95	93,875	13,815	44,865	48,813
96	134,624	6,896	18,229	18,885
97	84,946	10,621	31,485	32,115
98	76,580	14,737	47,770	48,964
99	107,537	30,757	110,066	110,837
00	133,984	23,294	82,316	81,246
01	**116,386**	**27,731**	**89,844**	**89,844**
Average	76,677	18,791	47,967	80,051
Std. deviation	31,689	10,486	29,697	50,920

Figure 3a. Estimated Bottomfish Boat Hours

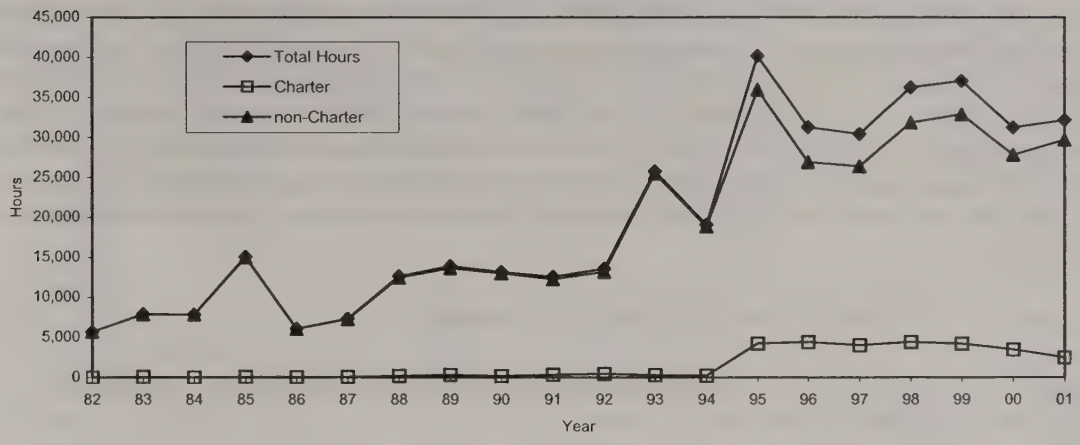
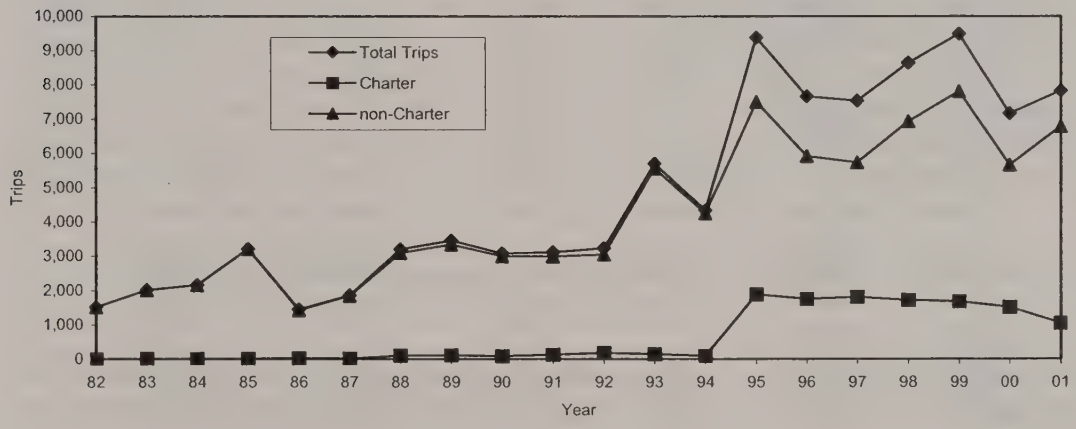


Figure 3b. Estimated Bottomfish Trips



Interpretations: The threefold increase in boating hours and doubling of bottomfish trips in 1995 may have been due to the 60% increase in the number of boats entering the fishery that year. Also, the number of calm days that year may have encouraged more bottomfishing activity than previous years. The increase in boat trips and hours may have also been due to adding the Agat Marina into the offshore survey in 1994. That year, the charter boat component of the bottomfish fishery accounted for 23% of the total number of

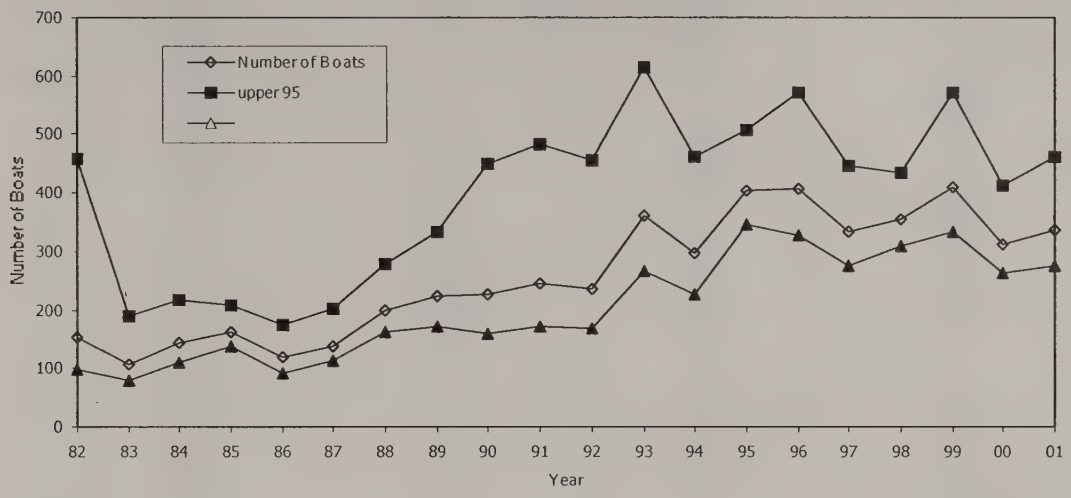
bottomfishing trips and 13% of the hours fished. This increase may have been due to the inclusion of the Agat Marina, which had several charter bottomfishing vessels that made multiple trips on each survey day. The number of charter trips decreased after 1997, possibly due to tourists participating in less expensive types of recreation. The slight declines in bottomfishing trips and hours in 1996 and 1997 were due to a number of typhoons that hit Guam those years. A return to more normal weather patterns in 1999 best explains the increases that year. The decreases in boating hours and trips observed in 2000 could be due to fishermen dropping out of the fishery due to poor catches in the shallow bottom complex. In 2001, overall hours and trips increased slightly, 3% and 9% respectively, with non-charter hours and trips increasing 7% and 20% respectively. The charter hours and trips, however, decreased 28% and 31% respectively. This sector, which is tourist dependent, continues to decrease due to a decrease in tourist numbers and a shift to less expensive activities by tourists.

Source: The DAWR creel survey data for bottomfishing method.

Calculations: The estimated number of boat trips and boat hours for bottomfishing methods are derived directly from the creel survey expansion algorithms.

Year	Total Hours	Non-charter hours	Charter hours	Total Trips	Non-charter trips	Charter trips
85	15,037	14,989	48	3,212	3,201	11
86	6,058	6,033	25	1,444	1,422	23
87	7,313	7,264	49	1,857	1,835	22
88	12,611	12,435	176	3,190	3,085	105
89	13,910	13,615	295	3,452	3,338	114
90	13,143	12,967	176	3,071	2,988	83
91	12,527	12,217	310	3,109	2,986	123
92	13,550	13,138	412	3,234	3,054	180
93	25,733	25,458	275	5,692	5,551	141
94	19,038	18,849	189	4,331	4,238	93
95	40,153	35,927	4,226	9,376	7,498	1,878
96	31,249	26,863	4,386	7,657	5,912	1,745
97	30,370	26,360	4,010	7,527	5,724	1,803
98	36,198	31,822	4,376	8,636	6,924	1,712
99	37,019	32,860	4,159	9,479	7,804	1,675
00	31,216	27,760	3,457	7,159	5,654	1,505
01	**32,140**	**29,665**	**2,475**	**7,820**	**6,783**	**1,038**
Average	19,933	18,479	1,454	4,796	4,183	613
Std. deviation	11,732	10,061	1,863	2,806	2,102	778

Figure 4. Guam bottomfish fishery participation



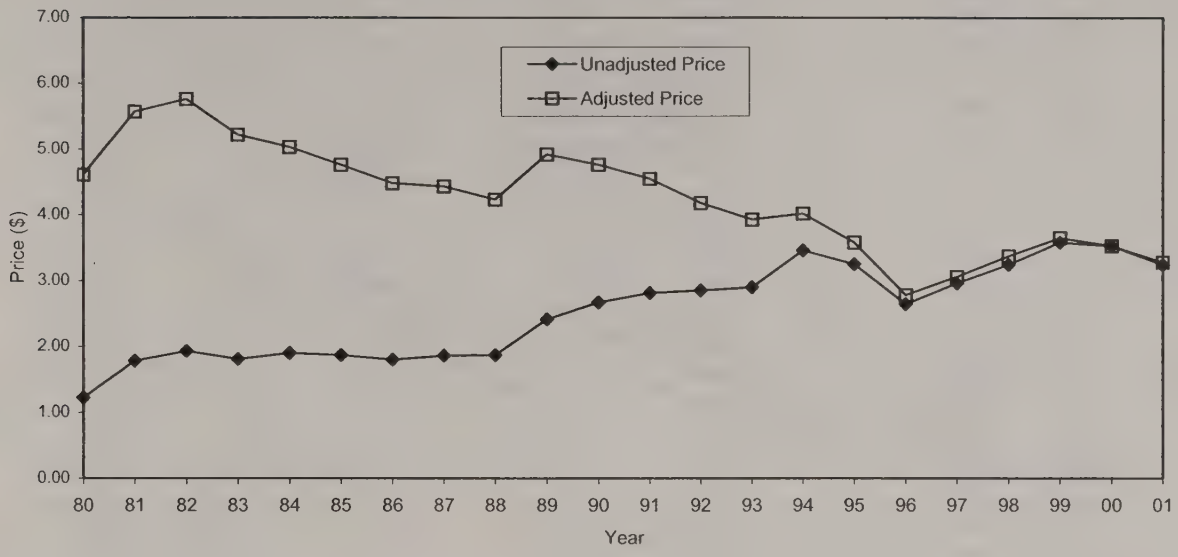
Interpretations: The number of boats participating in this fishery has leveled off in recent years, but generally increases during periods of better weather conditions and available marketing opportunities. The 57% increase in participation from 1992 and 1993 could be due to the inclusion of the Merizo Pier as a survey site in 1991, as well as a healthy economy that made it possible for more residents to afford boats. Another 57% increase occurred in 1995, due to the inclusion of the Agat Marina as an offshore creel survey site in October 1994. In general, most of the new boaters in the last six years are usually recreational vessels that bottomfish only part-time and primarily target the shallow-water bottomfish complex. A slight increase in the numbers of boats participating in bottomfishing occurred in 2001, increasing 8%.

Source: Offshore creel survey boat log data from DAWR's three sampled ports. The data was converted and processed using the WPacFIN-generated boat estimator model.

Calculations: The 2001 figure was obtained by first running the above-mentioned model 1,000 times using a randomly selected order of the days sampled at all three ports combined, then eliminating the upper and lower 25 estimates to rid the model of occasional outlier estimates; and finally calculating the mean and standard deviation for the remaining 950 estimates. The removal of the outliers conducted in the second step lowered the original estimated number of boats after the model was run 1,000 times by about 1%, but more important, reduced the standard deviation by approximately 20%.

Year	Lower95	Number of boats	Upper 95
82	99	154	459
83	80	106	190
84	111	144	218
85	138	161	207
86	93	118	175
87	112	139	202
88	162	198	278
89	172	223	333
90	159	226	450
91	170	246	482
92	167	236	456
93	266	360	615
94	226	298	463
95	346	402	507
96	327	408	573
97	276	332	447
98	308	354	435
99	333	411	573
00	263	312	413
01	**276**	**337**	**463**
Average	204	258	397
Std. Deviation	88	102	139

Figure 5. Average bottomfish prices



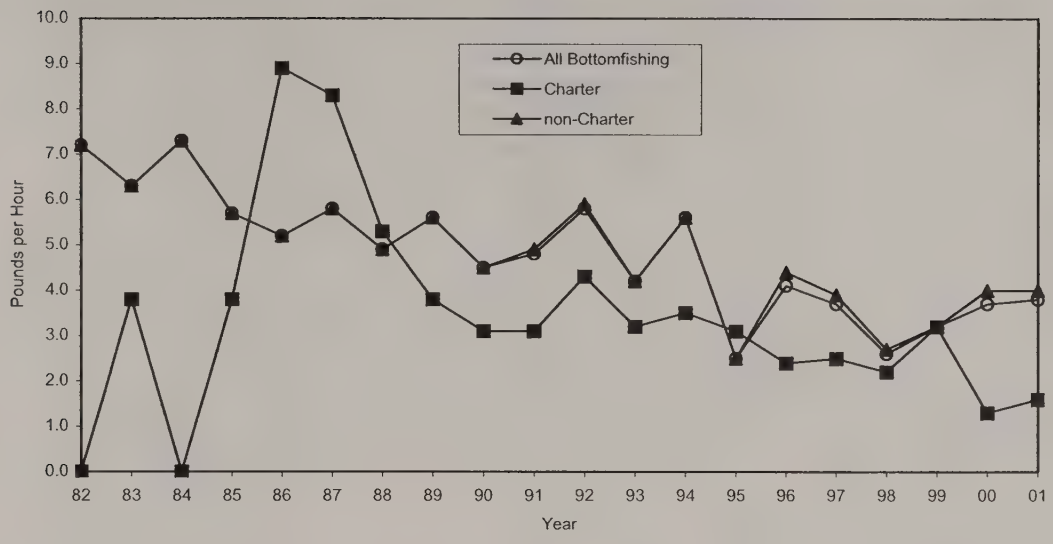
Interpretations: The decreases in adjusted fish prices observed prior to 1996 may have been the result of a consistent supply of reasonably priced fish and competition among vendors during those years. Roadside vendors importing fish from other islands did compete with and may have discouraged local vendors from increasing the price of locally caught bottomfish. These roadside vendors were shut down by the Department of Public Health due to health concerns, which resulted in the rise of bottomfish prices since less expensive fish from Micronesia could not be easily purchased. The adjusted average price for bottomfish has been increasing slightly from 1996 to 1999, and could likely have been the result of increased demand for a dwindling supply of locally caught fish. A slight decrease in fish prices occurred in 2001, decreasing 7%.

Source: The commercial landings data from the major wholesalers.

Calculations: The average price of all bottomfish species combined is calculated by dividing the total bottomfish revenue by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1998 figure as the base from which to calculate expansion factors for all previous years (e.g. divide the 1998 CPI by the CPI for any given year), and then multiplying the unadjusted average price by this factor to obtain the adjusted average price for the given year. A new "market basket" was created by the Department of Commerce in 1998, which resulted in the CPI figure being reset in 1999. The CPI for Guam did not change for 2000.

Year	Unadjusted Price $/lb	Adjusted Price $/lb
80	1.22	4.61
81	1.78	5.57
82	1.93	5.76
83	1.81	5.22
84	1.90	5.03
85	1.87	4.76
86	1.80	4.48
87	1.86	4.43
88	1.87	4.23
89	2.41	4.92
90	2.67	4.76
91	2.81	4.55
92	2.85	4.18
93	2.90	3.93
94	3.46	4.02
95	3.25	3.58
96	2.64	2.78
97	2.96	3.06
98	3.24	3.37
99	3.58	3.65
00	3.53	3.53
01	**3.24**	**3.28**
Average	2.53	4.26
Std.deviation	0.71	0.81

Figure 6. Guam Bottomfish CPUE



Interpretations: Prior to 1999, the CPUE for bottomfishing was reported as a single value. Because of yellow light situations in 1995 and 1998, the fishery was divided into charter and non charter components, since the charter boats in Agat were observed to have high effort and low catches which may have skewed the overall CPUE.

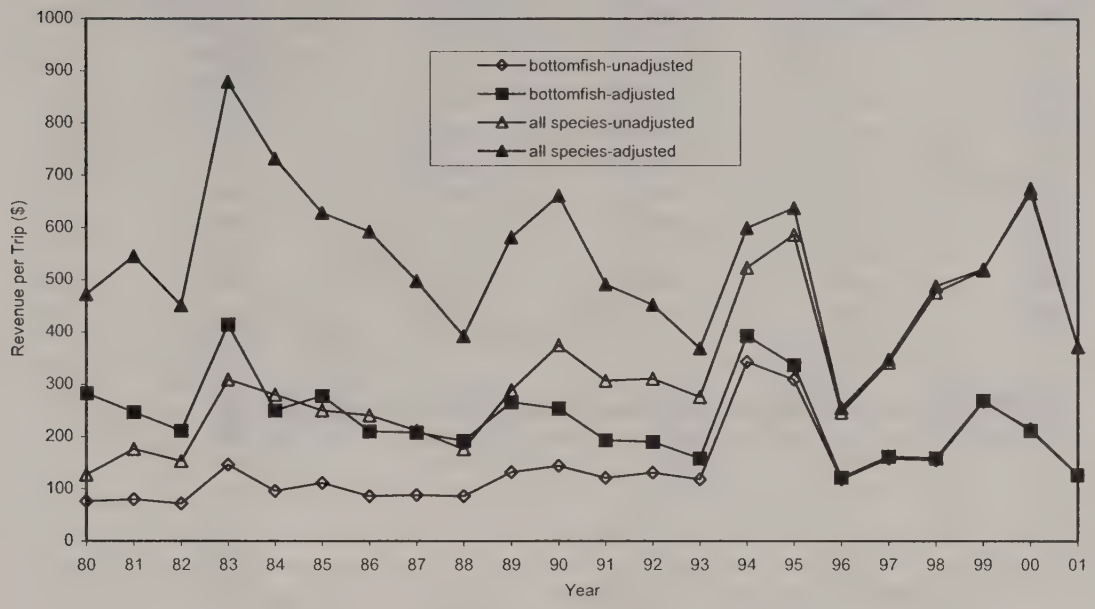
Historically, the CPUE has fluctuated around 4-6 pounds per hour and has, up until the last five years, remained fairly stable. In 1995 and 1998, the overall and non-charter CPUE fell below 2.8 pounds per hour, owing in large part to an increasing number of recreational and subsistence-type vessels continuing to enter into the fishery; most of which target the less-productive shallow-water bottomfish complex. Both 1995 and 1998 CPUE figures were less than a half of the aggregate CPUE average of 5.6 pounds per hour for the first three years reported using the new expansion system, placing the fishery in yellow light conditions those years. This indicates stress on the fishery, despite the rise in CPUE since 1999. The slight increase in overall CPUE was observed in 2001, 3%. The charter CPUE increased 23% in 2001, while the CPUE for non-charter boats remained the same. The 2001 CPUE values are still well below the 20-year average.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

	Catch per Unit Effort (lbs/hr)		
Year	**All Bottomfishing**	**Non-charter**	**Charter**
82	7.2	7.2	0
83	6.3	6.3	3.8
84	7.3	7.3	0
85	5.7	5.7	3.8
86	5.2	5.2	8.9
87	5.8	5.8	8.3
88	4.9	4.9	5.3
89	5.6	5.6	3.8
90	4.5	4.5	3.1
91	4.8	4.9	3.1
92	5.8	5.9	4.3
93	4.2	4.2	3.2
94	5.6	5.6	3.5
95	2.5	2.5	3.1
96	4.1	4.4	2.4
97	3.7	3.9	2.5
98	2.6	2.7	2.2
99	3.2	3.2	3.2
00	3.7	4.0	1.3
01	**3.8**	**4.0**	**1.6**
Average	4.8	4.9	3.4
Std.deviation	1.4	1.3	2.2

Figure 7. Guam average revenue per trip



Interpretations: The inflation-adjusted average revenue per trip for both the "bottomfish" and the "all species" categories decreased in 2001, 40% and 44% respectively. Previous drops in revenue were due to some of the more experienced fishermen not selling their catch to vendors participating in the DAWR commercial receipt book program. The increase in the amount of imported bottomfish from around Micronesia (Belau, Chuuk, Pohnpei, Kosrae, etc.) that began around 1991 with the addition of frequent airline routes to Guam, may explain the slight decrease in revenues between 1991 and 1993. Roadside vendors have, for the most part, been shut down, and most local vendors prefer purchasing locally caught fish. The substantial increases in the inflation-adjusted average revenue per trip in 1994 are best explained by the success of a few highliner vessels during that year. The decrease observed in 2001 may be partially due to commercial vendors not accepting bottomfish they consider too small for sale.

Source: The commercial landings data from major wholesalers.

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all species sold for any trip that landed bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trips is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips.

Year	$/Trip, Unadjusted Bottomfish	$/Trip, Adjusted Bottomfish	$/Trip, Unadjusted All Species	$/Trip, Adjusted All Species
80	76	283	127	472
81	80	247	176	545
82	72	211	153	451
83	146	414	309	879
84	96	250	280	732
85	111	278	250	628
86	86	210	241	592
87	88	208	212	498
88	86	192	176	392
89	132	266	289	581
90	144	254	375	661
91	121	193	307	491
92	131	190	311	452
93	118	158	276	369
94	343	393	523	599
95	309	337	586	637
96	118	122	246	255
97	158	162	342	348
98	155	159	476	488
99	267	269	518	521
00	215	212	675	666
01	**127**	**127**	**372**	**372**
Average	145	233	328	529
Std. deviation	75	77	146	143

Figure 8a. Jacks/Trevallys (*Caranx, Carangoides*): Harvest

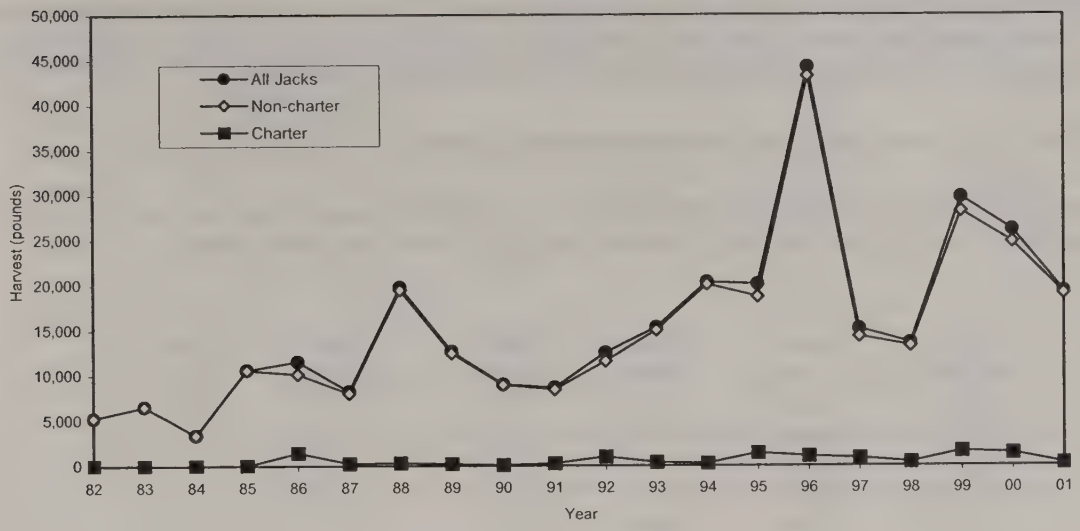
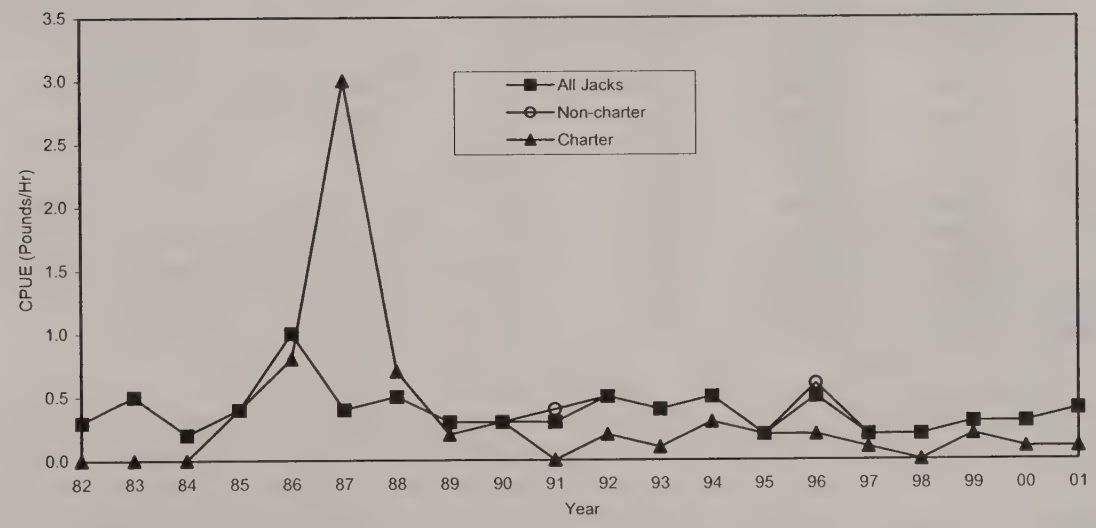


Figure 8b. Jacks/Trevallys *(Caranx, Carangoides)*: CPUE



Interpretations: The total, non-charter, and charter harvest of jacks decreased 26%, 23%, and 82% respectively between 2000 and 2001. Total and non-charter CPUE increased slightly in 2001, with charter CPUE remaining unchanged. It is hoped that the establishment of the marine preserves on Guam can lead to the increase in number and size of jacks harvested. Juvenile jacks are harvested as a seasonal fishery, making this species of fish targeted during most of its lifespan.

The charter harvest shows extreme fluctuations prior to 1995, then increased fivefold in 1995 with the inclusion of the Agat Marina bottomfish charter boats. Extreme fluctuations in charter harvest and charter CPUE is a reflection of the charter activity in Agat, which account for over 80% of the bottomfish charter activity. These charter boats have high effort, low catches, and fish primarily in the same area over the years, and their low CPUE values in recent years may be an indication of overfishing.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of jacks landed by the total number of hours spent bottomfishing.

Year	Harvest All Jacks	Harvest Non-charter	Harvest Charter	CPUE All Jacks	CPUE Non-charter	CPUE Charter
82	5,300	5,280	20	0.3	0.3	0
83	6,557	6,557	0	0.5	0.5	0
84	3,387	3,387	0	0.2	0.2	0
85	10,612	10,577	35	0.4	0.4	0.4
86	11,529	10,126	1,404	1.0	1.0	0.8
87	8,241	7,997	244	0.4	0.4	3.0
88	19,764	19,443	321	0.5	0.5	0.7
89	12,680	12,454	226	0.3	0.3	0.2
90	9,006	8,944	62	0.3	0.3	0.3
91	8,660	8,420	240	0.3	0.4	0
92	12,508	11,546	962	0.5	0.5	0.2
93	15,311	14,984	327	0.4	0.4	0.1
94	20,304	20,067	238	0.5	0.5	0.3
95	20,082	18,700	1,382	0.2	0.2	0.2
96	44,186	43,153	1,032	0.5	0.6	0.2
97	15,130	14,301	828	0.2	0.2	0.1
98	13,592	13,233	359	0.2	0.2	0
99	29,732	28,166	1,566	0.3	0.3	0.2
00	26,095	24,753	1,342	0.3	0.3	0.1
01	**19,277**	**19,039**	**238**	**0.4**	**0.4**	**0.1**
Average	15,598	15,056	541	0.4	0.4	0.3
Std. deviation	9.588	9,266	542	0.2	0.2	0.7

Figure 9a. Snappers (*Lutjanus, Pristipomoides, Aphareus, Etelis*): Harvest

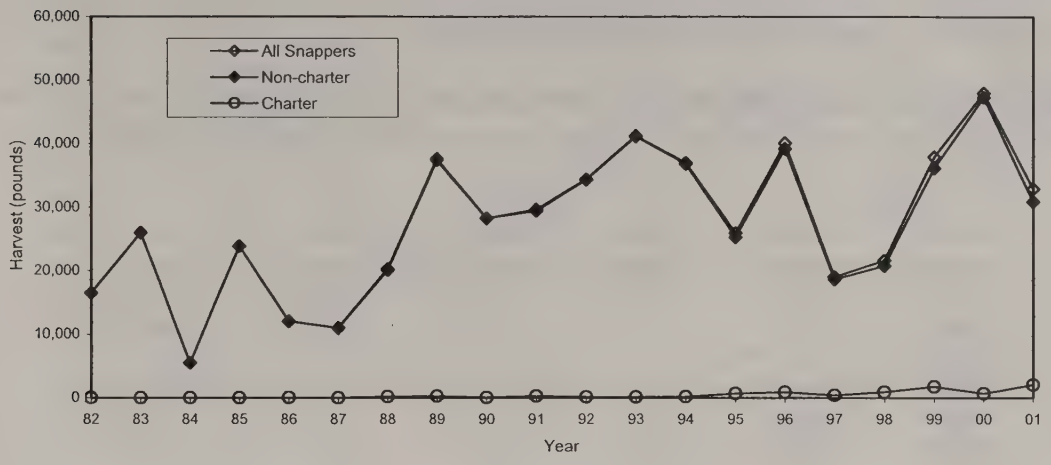
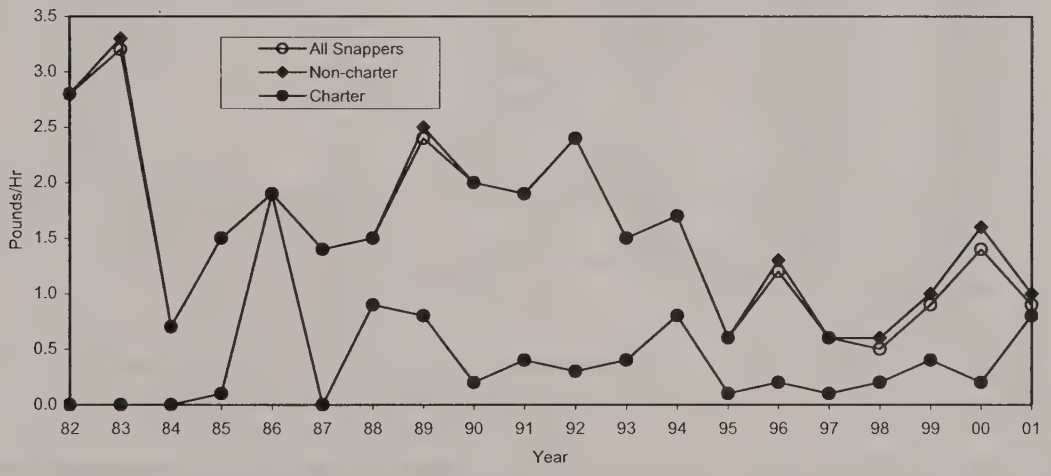


Figure 9b. Snappers *(Lutjanus, Pristipomoides, Aphareus, Etelis*): CPUE



Interpretations: The total and non-charter harvest of snappers decreased 31% and 35% respectively in 2001, while the charter harvest tripled. The total and non-charter CPUE decreased 36% and 38% respectively, while the charter CPUE quadrupled. The overall harvest of snappers appears to be increasing over time, while CPUE appears to show a decreasing trend. Since the harvest of snappers also includes deepwater species, the fluctuations in harvest could be due to targeting deepwater snapper species.

A significant increase in the charter harvest of snappers is observed in 1995 when the Agat Marina was

included as an offshore sampling port. Low catches and high effort, however, have resulted in low CPUE values after 1994. This may be skewed primarily by the Agat bottomfish charter boats, which account for approximately 85% of the yearly annual charter bottomfish trips.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of snappers landed by the total number of hours spent bottomfishing.

Year	Harvest All Snappers	Harvest Non-charter	Harvest Charter	CPUE All Snappers	CPUE Non-charter	CPUE Charter
82	16,472	16,472	0	2.8	2.8	0.0
83	25,945	25,945	0	3.2	3.3	0.0
84	5,475	5,475	0	0.7	0.7	0.0
85	23,833	23,830	4	1.5	1.5	0.1
86	12,029	11,983	46	1.9	1.9	1.9
87	10,951	10,951	0	1.4	1.4	0.0
88	20,214	20,054	161	1.5	1.5	0.9
89	37,604	37,367	237	2.4	2.5	0.8
90	28,242	28,198	44	2.0	2.0	0.2
91	29,591	29,352	239	1.9	1.9	0.4
92	34,377	34,257	119	2.4	2.4	0.3
93	41,214	41,094	120	1.5	1.5	0.4
94	36,955	36,802	153	1.7	1.7	0.8
95	25,884	25,209	675	0.6	0.6	0.1
96	40,059	39,182	877	1.2	1.3	0.2
97	19,014	18,624	391	0.6	0.6	0.1
98	21,597	20,720	877	0.5	0.6	0.2
99	37,895	36,130	1,765	0.9	1.0	0.4
00	47,940	47,289	652	1.4	1.6	0.2
01	**32,896**	**30,843**	**2,053**	**0.9**	**1.0**	**0.8**
Average	27,409	26,989	421	1.6	1.6	0.4
Std. deviation	11,338	11,120	588	0.8	0.8	0.5

Figure 10a. Groupers (*Epinephelus, Cephalopholis, Variola*): Harvest

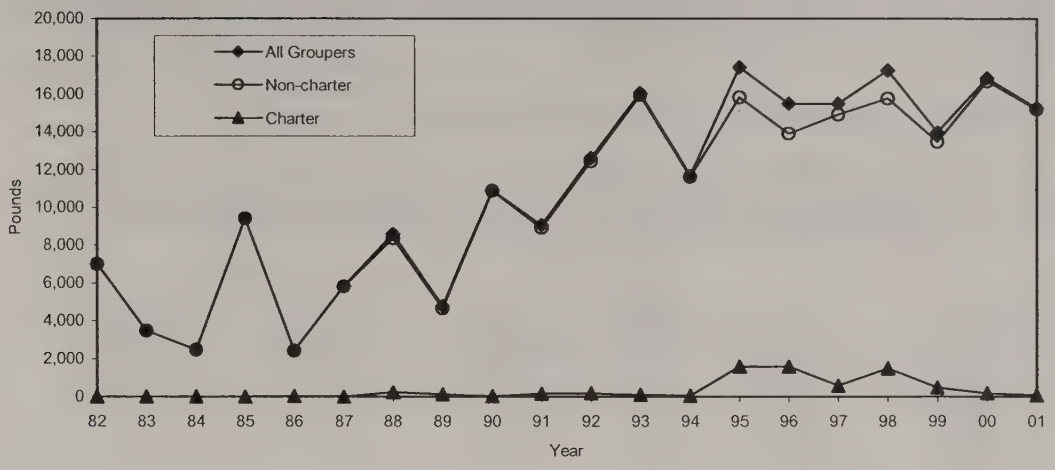
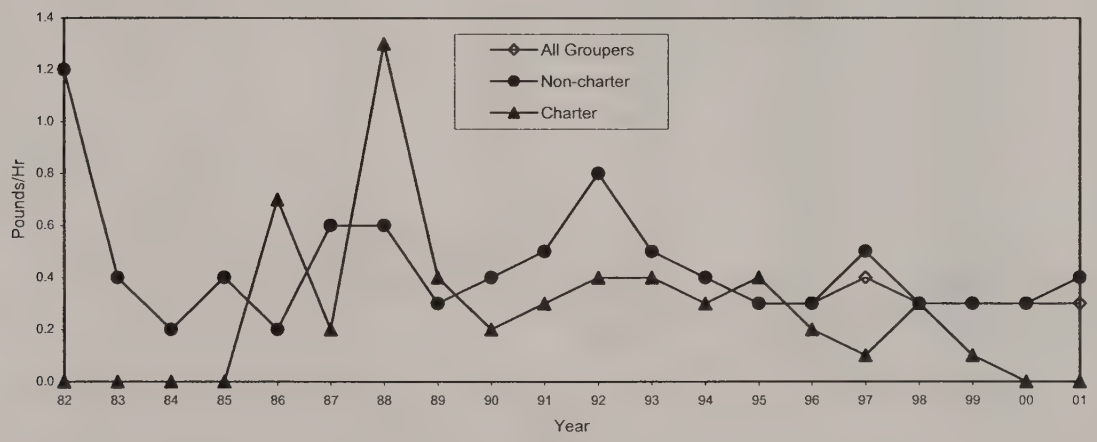


Figure 10b. Groupers *(Epinephelus, Cephalopholis, Variola)*: CPUE



Interpretations: The total and non-charter harvest of groupers both decreased 9% in 2001. The CPUE for total and charter harvest of snappers remained the same for 2001, while non-charter CPUE increased slightly from 0.3 to 0.4 pounds per hour. The overall harvest of groupers appears to be leveling off since 1992, while CPUE appears to show a decreasing trend. This could be due to the harvest of smaller groupers, since large groupers are not commonly caught by bottomfishing. In recent years, the number of large groupers have been observed to be harvested more by spearfishing than bottomfishing by Fisheries staff.

The harvest of groupers by charter boats increased significantly with the inclusion of the Agat Marina as an

offshore sampling port. The CPUE for charter boats, however, is decreasing. In 2001, the charter harvest of groupers decreased 59%, with the CPUE remaining near zero. This trend is a reflection of the Agat charters, which account for over 85% of charter activity on Guam. These charter boats have low catches, high effort, and fish in the same general area. High effort by charter boats in relatively the same fishing areas has resulted in the harvest of large numbers of juveniles.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of groupers landed by the total number of hours spent bottomfishing.

Year	Harvest All Groupers	Harvest Non-charter	Harvest Charter	CPUE All Groupers	CPUE Non-charter	CPUE Charter
82	7,000	7,000	0	1.2	1.2	0.0
83	3,471	3,471	0	0.4	0.4	0.0
84	2,463	2,463	0	0.2	0.2	0.0
85	9,410	9,410	0	0.4	0.4	0.0
86	2,442	2,425	17	0.2	0.2	0.7
87	5,823	5,814	9	0.6	0.6	0.2
88	8,594	8,359	236	0.6	0.6	1.3
89	4,795	4,668	127	0.3	0.3	0.4
90	10,907	10,879	28	0.4	0.4	0.2
91	9,076	8,918	158	0.5	0.5	0.3
92	12,609	12,435	175	0.8	0.8	0.4
93	16,037	15,939	97	0.5	0.5	0.4
94	11,677	11,620	57	0.4	0.4	0.3
95	17,411	15,826	1,585	0.3	0.3	0.4
96	15,500	13,906	1,594	0.3	0.3	0.2
97	15,480	14,906	573	0.4	0.5	0.1
98	17,252	15,759	1,493	0.3	0.3	0.3
99	13,969	13,484	484	0.3	0.3	0.1
00	16,846	16,663	183	0.3	0.3	0.0
01	**15,252**	**15,177**	**75**	**0.3**	**0.4**	**0.0**
Average	10,801	10,456	345	0.4	0.4	0.3
Std. deviation	5,157	4,846	545	0.2	0.2	0.3

Figure 11a. Emperors (*Lethrinus, Gnathodentex, Gymnocranius, Montaxis*): Harvest

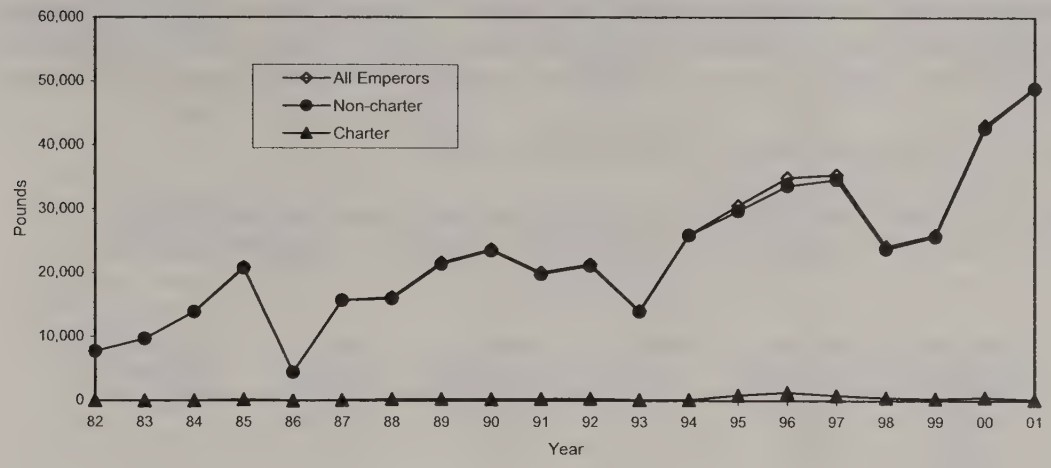
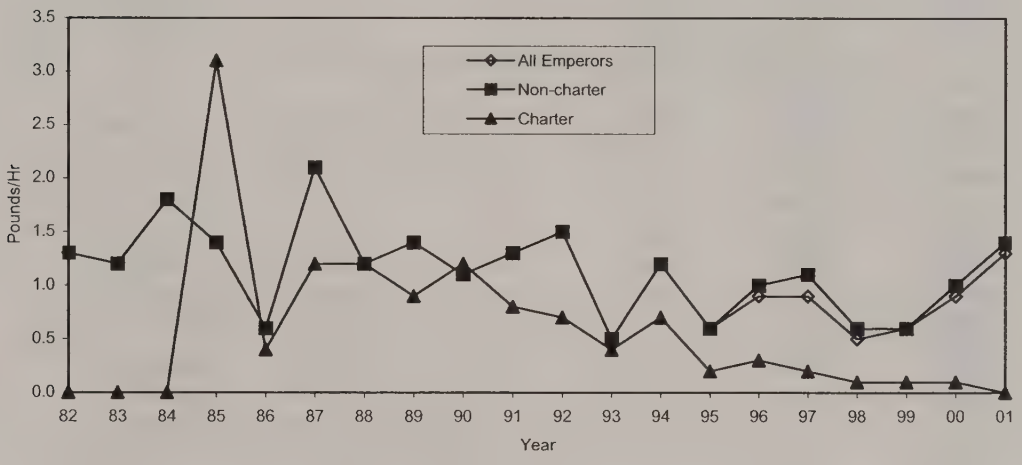


Figure 11b. Emperors *(Lethrinus, Gnathodentex, Gymnocranius, Monotaxis*): CPUE



Interpretations: The total and non-charter harvest of emperors increased 14% and 15% in 2001. The CPUE for total and non-charter harvest of snappers also increased, increasing 44% and 40% respectively in 2001. The increased in the harvest of emperors in both the charter and non-charter sectors in 1995 and 1996 may have be due to the addition of the Agat Marina as an offshore sampling port. The CPUE for emperors, however, decreased 50% between 1994 and 1995. The overall harvest of emperors appears to be increasing, while CPUE shows a decreasing trend. Total and non-charter CPUE, however, has been increasing since 1999.

The harvest of emperors by the charter sector increased significantly with the inclusion of the Agat charters in 1995. However, harvest by charter boats appear to be decreasing after an initial increase. Since the Agat charters make up to 80% of bottomfish charter activity, their low catches, high effort, and tendency to fish in the same general area may have resulted in low emperor catches. Currently, emperors are rarely observed with charter boats. The harvest of emperors by charter boats decreased 76% in 2001, with the CPUE decreasing to nearly zero. Both the harvest and CPUE for the charter sectors fall below the 20-year average.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

Year	Harvest All Emperors	Harvest Non-charter	Harvest Charter	CPUE All Emperors	CPUE Non-charter	CPUE Charter
82	7,677	7,677	0	1.3	1.3	0.0
83	9,635	9,635	0	1.2	1.2	0.0
84	13,843	13,843	0	1.8	1.8	0.0
85	20,841	20,691	149	1.4	1.4	3.1
86	4,411	4,402	9	0.6	0.6	0.4
87	15,706	15,648	58	2.1	2.1	1.2
88	16,123	15,909	215	1.2	1.2	1.2
89	21,599	21,341	257	1.4	1.4	0.9
90	23,637	23,417	220	1.1	1.1	1.2
91	20,030	19,774	256	1.3	1.3	0.8
92	21,333	21,049	283	1.5	1.5	0.7
93	14,033	13,913	121	0.5	0.5	0.4
94	25,949	25,827	122	1.2	1.2	0.7
95	30,498	29,657	840	0.6	0.6	0.2
96	34,879	33,578	1,301	0.9	1.0	0.3
97	35,323	34,550	773	0.9	1.1	0.2
98	24,139	23,700	439	0.5	0.6	0.1
99	25,941	25,620	321	0.6	0.6	0.1
00	43,103	42,607	496	0.9	1.0	0.1
01	**48,961**	**48,844**	**117**	**1.3**	**1.4**	**0.0**
Average	22,883	22,584	299	1.1	1.1	0.6
Std. deviation	11,443	11,254	335	0.4	0.4	0.7

12a. Guam 2001 Bottomfish Bycatch: Charter

Species	Released alive	Released dead/injured	Total # Released	Total Number Landed	% Bycatch
C. longimanus		2	2	2	100.0
Triaenodon obesus	1		1	1	100.0
Holocentridae	6		6	6	100.0
S. tieroides	3		3	4	75.0
M. berndti	12		12	28	24.9
Serranidae	14		14	37	37.8
Serranidae	14		14	37	37.8
E. fasciatus	9		9	214	4.21
E. hexagonatus	5		5	7	71.4
E. merra	51		51	303	16.8
Snappers (Deep)	2	1	1	1	100.0
Lutjanus kasmira	2		2	91	2.2
Lethrinidae	111		111	197	56.4
L. rubrioperculatus	11		11	444	2.5
Siganus argenteus	3		3	5	60.0
Balistidae	14		14	14	100.0
B. undulates	6		6	10	60.0
B. viridescens	1		1	2	50.0
M. niger	2		2	3	66.7
O. niger	5		5	13	38.5
R. aculeatus	3		3	50	6.0
S. freanatus	3		3	21	14.3
TOTAL	**262**	**3**	**265**	**1,453**	**18.2**
Compared with All Species				**3,454**	**7.7**

12b. Guam 2001 Bottomfish Bycatch: Non-Charter

Species	Released alive	Released dead/injured	Total # Released	Total # Landed	% Bycatch
Holocentridae	13		13	13	100.0
Serranidae	12		12	18	66.7
C. urodeta	1		1	2	50.0
E. fasciatus	8		8	10	80.0
Lutjanidae	4		4	4	100.0
L. rubrioperculatus	3		3	9	33.3
Mullidae	44		44	44	100.0
M. pflugeri	7		7	9	77.8
P. ciliatus	1		1	1	100.0
P.multifasciatus	39		39	41	95.1
X. aneitensis	3		3	3	100.0
Balistidae	53		53	53	100.0
B. undulates	4		4	8	50.0
M. niger	97		97	110	88.2
M. vidua	97		97	110	88.2
O. niger	51		51	57	89.5
S. bursa	10		10	10	100.0
S. freanatus	4		4	4	100.0
A. scriptus	1		1	1	100.0
TOTAL	**338**	**0**	**338**	**402**	**89.1**
Compared with All Species				**442**	**81.0**

12c. Guam 2001 Bottomfish Bycatch: Summary

Year	Released alive	Released dead/injured	Total # Released	Total # Landed	% Bycatch	Bycatch Interviews	Total # of Interviews	% interviews with Bycatch
2001	620	3	623	1,855	89.1	58	183	31.7

Interpretation: A description of bycatch was done for for 2001 based solely on interviews obtained, and not from expanded data. A total of 183 bottomfish interviews were taken during 2001, with 58 of those interviews (32%) indicating that bycatch was obtained. Comparing between non-charter and charter interviews, 20 interviews out of 24 charter interviews (83%) and 38 out of 159 non-charter interviews (24%) indicated bycatch. The majority of the charter interviews were obtained from the Agat Marina, since bottomfish charters at the Agana Boat Basin, which usually have a greater variety of species, are not commonly interviewed. The Agana Boat Basin bottomfish charter boats generally do trolling, and those doing bottomfish charters generally return outside of the survey time period. However, the sizes of fishes caught at the Agana Boat Basin are not . Generally, most bycatch caught by charter and non-charter boats are released alive and generally undersized and juveniles. Exceptions to these during 2001 were sharks. Unfortunately, fish not considered preferable eating fish, such as filefish (*A. scriptus*), triggerfish, porcupine puffers, angelfishes, and cornetfishes have been caught in the past several years.

Source: The DAWR creel survey data for bottomfishing method.

Calculations: The total bycatch is obtained from the interviews obtained from bottomfishing interviews. The numbers recorded is not an expanded data, but obtained directly from the bottomfish interviews obtained during 2001. Each bycatch has an associated number of each individual fish species, an estimated length, and a calculated weight based on the estimated length.

Appendix 3

Hawaii

CONTENTS

page

Summary 3-2

Historical Annual Statistics 3-3

List of Tables 3-6

List of Figures 3-6

Introduction 3-8

Recommendations 3-8

Summary

In 2001, none of the five BMUS species for which SPR values are calculated have values below the 20% critical threshold that defines recruitment overfishing under the FMP. Estimates range from a low of 25% for onaga to a high of 48% for hapuupuu and opakapaka when viewed on an archipelago-wide basis. Implementation of the state bottomfish management plan (which became law in June 1998) should bring an improvement to the locally depleted status of ehu and onaga in the MHI and thereby increase the archipelago-wide SPR estimates for these species.

The MHI bottomfish fishery, though showing signs of stress, has remained relatively stable over the last few years. Landings recorded to date for 2001 are lower than the revised landings reported for 2000. CPUE for the MHI is up from last year (184 lb/trip vs 187 lb/trip). Stocks of many of the BMUS species in this zone show clear signs of stress. Each of the BMUS species evaluated, with the exception of opakapaka, has a yellow light condition due to a drop in CPUE below 50% of original values. In addition, onaga stocks are severely depleted on a local basis as the MHI SPR values for these species are at or below 20% (4% for onaga). These SPR levels are below the critical theshold that would signify recruitment overfishing if present on a stock-wide basis and demand immediate action (state bottomfish management measures, when implemented, should meet this need). Hapuupuu SPR values calculated for the MHI are 24% for 2000 (revised upward from 25% reported last year when calculations were based on incomplete reporting) and 28% for 2001.

Bottomfish resources in the NWHI remain relatively healthy. CPUE on a per trip basis dropped to 13% of the original level in the Mau Zone (down 54% from the 1997 level) and 3% in the Hoomalu zone (essentially the same as the 1998 value). On a per day basis CPUE values are up 9% in the Mau zone and down 10% in the Hoomalu. Analysis of SPR and percent immature in the catch show no localized depletion problems to date for any BMUS species in either zone, however, the mean weight of onaga in the Mau zone did drop dramatically in 1998.

Armorhead stocks outside of the US EEZ experienced a short pulse in recruitment in 1992 which did not carry over into 1993. The 1993 SPR values at Southeast Hancock Seamount are the highest recorded since 1986, but at 2.5%, they still indicate a collapsed fishery. Data for Hancock Seamount has not been available since 1994, and data outside the EEZ has been unavailable since 1998. SPR values obtained at Colahan Seamount have been shown to correlate well with values from Hancock Seamount and can be used as a proxy value. The 1997 SPR for Colahan Seamount was 1.1%, indicating a collapsed fishery. As a result, data has been unavailable for Colahan Seamount since 1887.

Historical Annual Statistics Main Hawaiian Islands						
Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	810348	274	$2,052,000	$2.71	538	33
1987	783569	237	$2,345,000	$3.14	535	25
1988	1164492	329	$3,288,000	$2.97	572	37
1989	1006142	361	$3,090,000	$3.29	537	40
1990	645802	245	$2,242,000	$3.76	501	27
1991	547800	202	$1,713,000	$3.35	469	24
1992	587471	228	$1,842,000	$3.40	407	25
1993	347960	213	$1,535,000	$3.60	403	24
1994	457956	217	$1,793,000	$3.65	423	24
1995	439625	193	$1,818,000	$3.48	400	22
1996	439867	125	$1,593,000	$3.92	487	21
1997	512554	176	$1,589,000	$3.39	502	20
1998	478802	130	$1,517,000	$3.47	498	20
1999	455131	209	$1,393,000	$3.43	483	25
2000	496989	187	$1,641,000	$3.67	495	21
2001	322523	184	$1,266,000	$3.66	379	20
Ave.	593564	219	$1,919,813	$3.48	477	26
s.d.	235493	62	$573,174	$0.24	58	6

Historical Annual Statistics Mau Zone						
Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	2206	NA	NA	NA	41
1987	NA	2889	NA	NA	NA	50
1988	NA	2136	NA	NA	4	37
1989	118000	4463	$309,000	$3.63	5	91
1990	249000	3435	$629,000	$3.25	14	77
1991	103000	1199	$300,000	$3.50	14	42
1992	71000	1273	$206,000	$3.39	8	38
1993	98000	1321	$266,000	$3.03	8	36
1994	160000	1573	$509,000	$3.25	12	68
1995	166000	1635	$471,000	$2.97	10	45
1996	135000	1543	$402,000	$3.22	13	53
1997	105000	1976	$368,000	$3.54	9	61
1998	66000	1689	$208,000	$2.88	7	42
1999	54000	1808	$180,000	$3.27	7	51
2000	49000	1053	$162,000	$3.42	6	42
2001	50000	916	$141,000	$2.79	6	36
Ave.	109538	1945	$319,308	$3.24	9	51
s.d.	57573	941	$149,612	$0.26	3	16

Historical Annual Statistics Hoomalu Zone						
Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	5301	NA	NA	NA	75
1987	NA	8187	NA	NA	NA	113
1988	NA	4702	NA	NA	12	66
1989	184000	5481	$454,000	$3.31	5	70
1990	173000	5403	$450,000	$3.22	5	64
1991	283000	5871	$761,000	$3.13	4	82
1992	353000	9464	$1,058,000	$3.34	5	98
1993	287000	8412	$888,000	$3.32	4	109
1994	283000	6903	$964,000	$3.40	5	64
1995	202000	6130	$630,000	$3.11	5	73
1996	176000	6216	$553,000	$3.41	3	78
1997	241000	6351	$777,000	$3.22	6	65
1998	266000	5315	$832,000	$3.05	7	66
1999	269000	5611	$962,000	$3.56	6	62
2000	213000	5909	$718,000	$3.78	5	62
2001	236000	5757	$744,000	$3.15	5	64
Ave.	243538	6313	$753,154	$3.31	6	76
s.d.	53183	1305	$192,349	$0.20	2	17

Tables

page

1. Hawaii Bottomfish species landings and prices, 1996 & 1997 3-21

2. Ho'omalu zone bottomfish vessel, income statement, 1997 3-22

3. Mau zone bottomfish vessel, income statement, 1997 3-23

Figures

1. Hawaii's bottomfish landings from the NWHI and MHI 3-9

2a. NWHI BMUS species composition of landings per trip by weight, for the Mau Zone 3-11

2b. NWHI BMUS species composition of landings per trip by weight, for the Hoomalu Zone 3-13

3. NWHI BMUS species composition of landings by weight 3-15

4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones 3-17

5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones 3-19

6. MHI species composition of landings by weight 3-26

7. MHI reported effort and participation 3-28

8. Hawaii bottomfish landings, revenue, prices, 1970-97. (Inflation adjusted) 3-31

9. Hawaii bottomfish market landings, revenue, and prices by source, 1970-present (Inflation adjusted.) 3-34

10. Hawaii bottomfish ex-vessel prices by source, 1987-present (Price adjusted for inflation) 3-37

11. Hawaii bottomfish ex-vessel prices by NWHI zone, 1989-present (Inflation adjusted prices) 3-38

Figures (cont.)

page

12. Hawaii Bottomfish Demand 3-42

13. NWHI bottomfish inflation-adjusted revenue per trip by zone, 1989-present 3-43

14a. CPUE for Hawaiian bottomfish 3-45

14b. Partial CPUE for MHI bottomfish 3-49

14c. Partial targeted CPUE for MHI bottomfish 3-52

15. Percent Immature in Hawaiian Bottomfish Catch 3-55

16. Mean Weight of Hawaiian Bottomfish 3-57

17 Archipelago wide Spawning potential ratio (SPR). 3-59

18 Spawning potential ratio (SPR) for MHI bottomfish. 3-61

19a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE 3-63

19b. Spawning potential ratio (SPR) for NWHI bottomfish using targeted CPUE 3-65

20. Research CPUE on SE Hancock Seamount 3-68

21. Armorhead Spawning potential ratio 3-71

22. CPUE for Hancock and Colahan Seamounts 3-72

Introduction

The commercial bottomfish stocks in the Hawaiian Islands are divided into two fisheries: seamount groundfish and deep-slope bottomfish. The seamount fishery targets alfonsin, *Beryx* spp., and armorhead, *Pseudopentaceros wheeleri*. The only area in the US EEZ for this fishery is Southeast Hancock Seamount located 1,400 nm northwest of Honolulu. This trawl fishery was started by the Russians and Japanese in the late 1960s and large catches were made for about 10 years until they caused a crash in the fishery. This fishery has never been domestically harvested. A moratorium on fishing within the US EEZ began in 1986 and continues through the present as no substantial recovery in the fishery has been observed.

The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids, and a single species of grouper concentrated at depths of 30-150 fathoms. These fish have been fished on a subsistence basis since ancient times and commercially for at least 90 years. The deep-slope fishing grounds within the US EEZ are divided into three management zones. The inhabited main Hawaiian Islands (MHI) support numerous subsistence, recreational, and commercial fishermen with considerable overlap by category. The uninhabited Northwestern Hawaiian Islands (NWHI) are divided into the Mau Zone, closer to the MHI, and the Hoomalu Zone. Fishing in these zones is conducted solely by commercial fishermen and requires federal licensing for such activities. The Hoomalu Zone is a limited entry zone with 4 vessels participating in 2001; 5 vessels fished the Mau Zone in the same year.

Vessel size varies considerably with larger fully commercial vessels (30 ft in length and over) conducting trips of about 10 days, and smaller vessels (<30 ft) generally restricted to the MHI and trips of 1-3 days. Most vessels in this fishery are fully outfitted with electronic navigation and fish-finding equipment, as well as with electric or hydraulic line-hauling equipment. The catch is sold fresh in the round for local consumption.

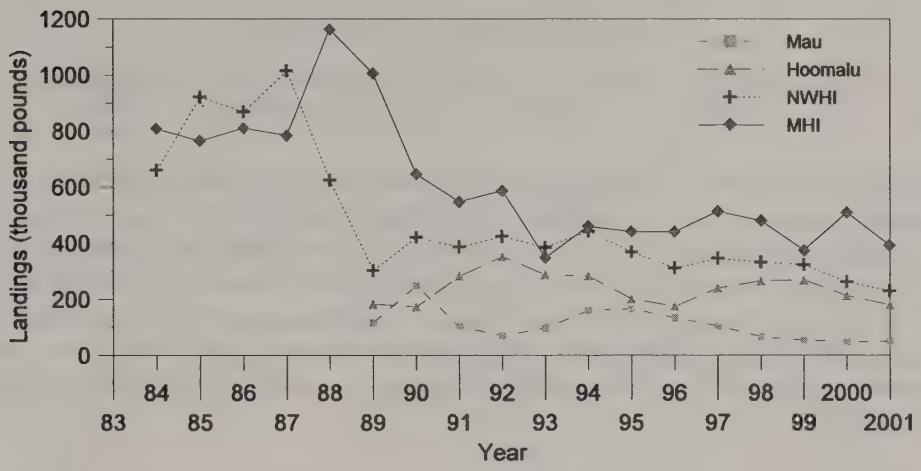
Catch and revenue data for bottomfish have been collected by the State of Hawaii Division of Aquatic Resources (HDAR) since 1948 in the form of a report submitted by commercial fishermen. No data is collected for recreational or subsistence fishermen, but their catch is estimated to be about equal to the commercial catch in the MHI. Data obtained from a market monitoring program and data from fishermen interviews are combined with the HDAR data set for most of the analysis presented in this report.

Recommendations

The Plan Team recommends:

The Council should request the State of Hawaii to change the mandatory NWHI daily logbook format to include the disposition of catch, ie. live release or dead release, of the released fish.

Figure 1. Hawaii's BMUS landings from the NWHI and MHI



	BMUS Landings (1000 lb)			
Year	Mau	Hoomalu	Total NWHI	MHI[2]
1984	NA	NA	661	807
1985	NA	NA	922	763
1986	NA	NA	869	810
1987	NA	NA	1015	783
1988	NA	NA	625	1164
1989	118	184	303	1006
1990	249	173	421	646
1991[1]	103	283	387	548
1992[1]	71	353	424	587
1993[1]	98	287	385	348
1994[1]	160	283	443	458
1995[1]	166	202	369	440
1996[1]	133	176	309	440
1997[1]	105	241	346	513
1998[1]	66	266	332	479
1999[2]	54	269	323	455
2000	49	213	262	509
2001[3]	**50**	**236**	**286**	**391**
mean	109.38	243.54	482.33	619.28
s.d.	57.50	53.18	234.50	224.70

[1] NWHI data from combination NMFS and HDAR
[2] Data from HDAR
[3] MHI data not complete.

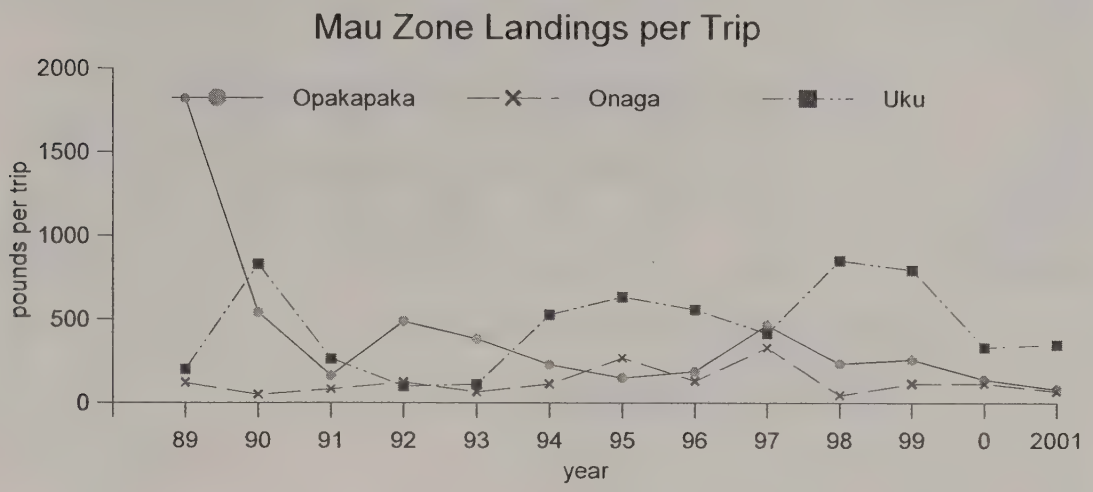
Source: Data are from HDAR. Data are only those from BMUS. Pelagic species data were not included.

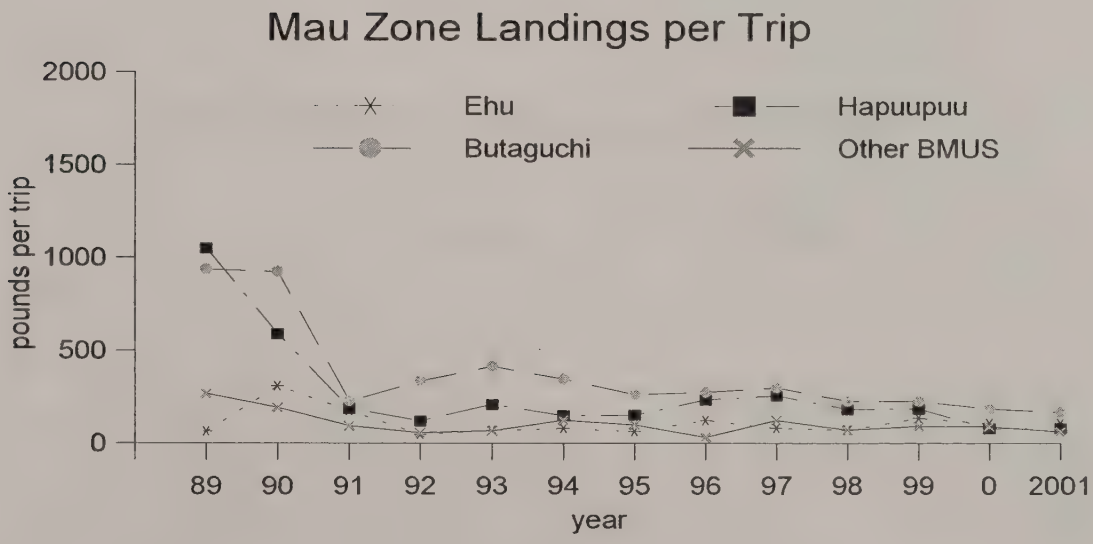
Calculation & Adjustment: The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other data were from HDAR daily logs and trip sales that were not entered into the system due to protocol/regs on out of State landings. Supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

Comments & Interpretation: The vessel sales reports indicate that the total NWHI BMUS landings were higher than that of last year. Both the Mau and Hoomalu zones increased their landings and sales of BMUS. The NWHI fishing fleet within both zones retained the identical number and vessels as in 2000. The increases were due to an increased number of trips while posting a slight decrease in landings per trip(fig. 2).

Figure 2a. Northwestern Hawaiian Islands Mau Zone BMUS species composition of landings per trip, by weight.





NWHI BMUS average pounds sold per trip by species, Mau Zone

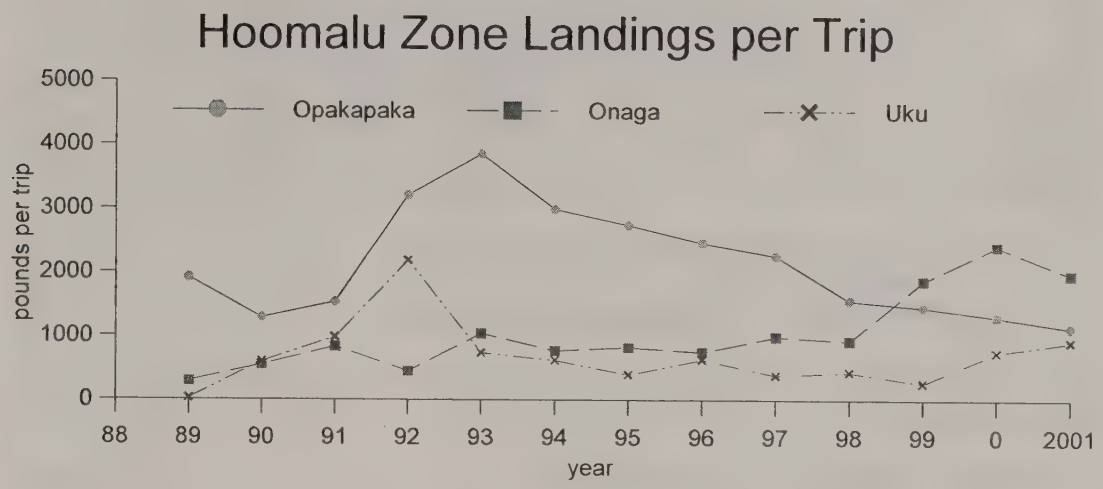
Species	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]	2000[2]	2001[2,3]
Opakapaka	488	382	229	149	187	465	235	259	138	80
Onaga	124	66	114	270	132	331	47	115	116	70
Ehu	48	69	81	65	123	82	72	136	108	109
Uku	100	112	529	635	558	417	852	796	333	343
Hapuupuu	121	210	150	153	235	257	184	187	81	81
Butaguchi	336	415	346	264	276	300	227	227	187	171
Other BMUS	56	67	124	99	32	124	72	91	90	62
Total per trip	1273	1321	1573	1635	1543	1976	1689	1811	1053	916

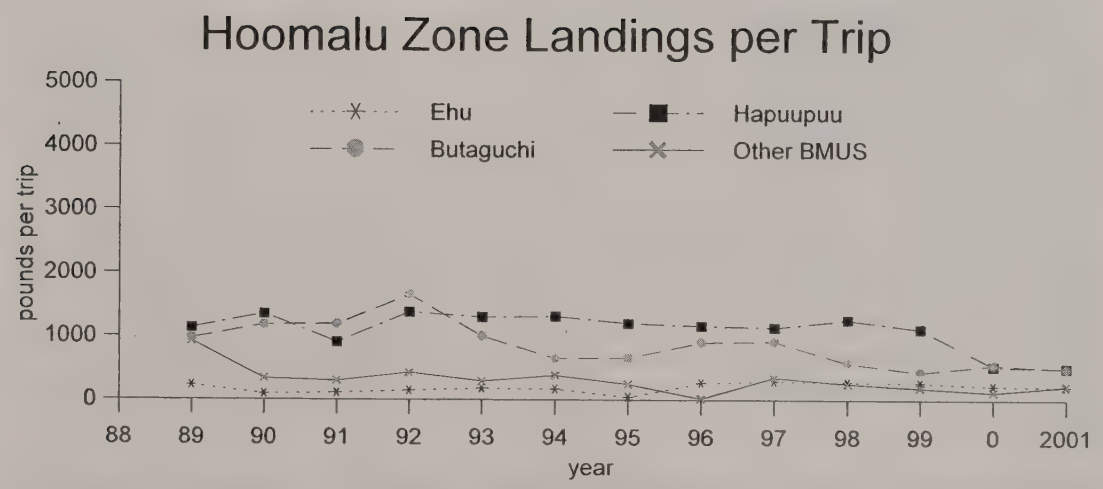
[1] Data from combination of NMFS and HDAR data sets.

[2] Data from HDAR data set.

[3] 2001 data are a combination of HDAR data sets.

Figure 2b. Northwestern Hawaiian Islands Hoomalu Zone BMUS species composition of landings per trip, by weight.





NWHI BMUS average pounds sold per trip by species, Hoomalu Zone

Species	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]	2000[2]	2001[2,3]
Opakapaka	3208	3849	2984	2741	2426	2258	1556	1454	1304	1530
Onaga	450	1042	771	825	752	993	931	1872	2417	1680
Ehu	148	185	172	47	272	298	285	273	225	187
Uku	2187	736	623	397	632	387	438	266	750	970
Hapuupuu	1386	1305	1318	1206	1166	1141	1266	1119	535	645
Butaguchi	1660	1004	655	665	909	923	583	439	556	549
Other BMUS	425	291	380	249	21	351	256	188	122	196
Total per trip	9464	8412	6903	6130	6216	6351	5315	5611	5909	5757

[1] Data from combination of NMFS and HDAR data sets.

[2] Data from HDAR data set.

[3] 2001 data are a combination of HDAR data sets.

Source: The 2000 data are from HDAR. Data are only those from BMUS. Pelagic species data were not included.

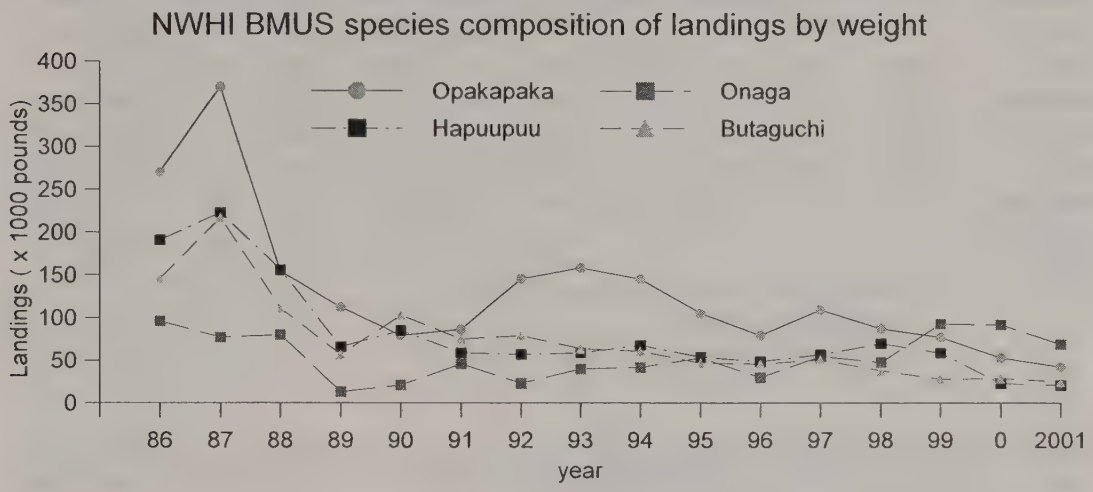
Calculation & Adjustment: The BMUS data were totaled by zone and divided by the number of trips to each zone. The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

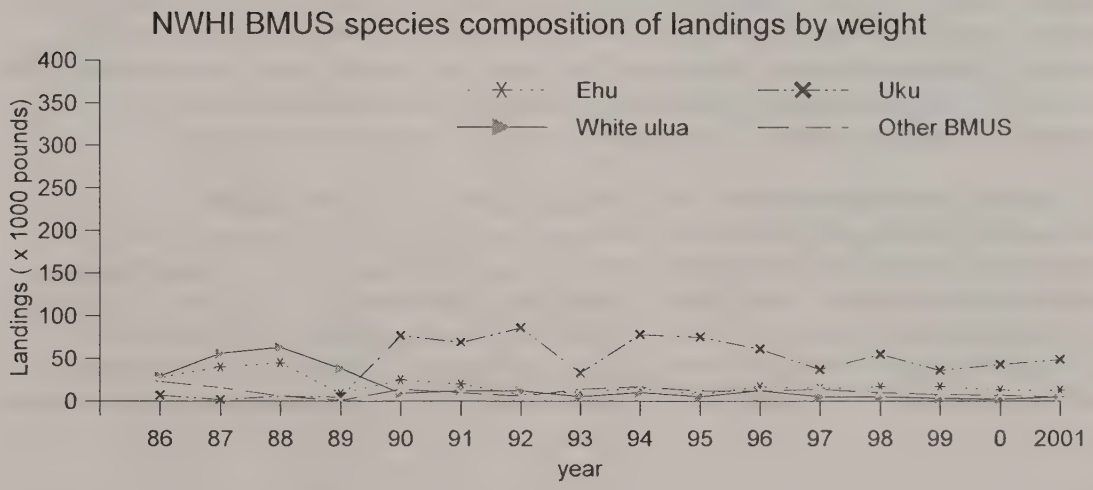
Comments & Interpretations: The Mau zone landing per trip decreased by 13% from last year. The Mau zone has had the same 6 vessels fishing for 2 consecutive years. The home ports of these vessels are divided evenly with 3 from Kauai and 3 from Oahu. The vessels based on Kauai have been increasingly targeting pelagic species for most of the year making many short trips that specifically target these seasonally abundant species. The effort by these vessels is characterized by many 2-5 day trips on which 1 day or less is spent on targeting bottomfish species. In looking at the Mau zone data table the per trip catches of onaga and opakapaka have lagged these last 2 years after the exit of one of the full time vessel and the multipurpose vessels driving the targeting away from bottomfish and focusing on pelagics for most of the year. During the winter season when the bottomfish are more abundant they may dedicate some trips wholly to bottomfishing but this appears to be the exception. The Oahu component is more focused on full time bottomfishing. They divide their time between bottomfishing the Mau zone and the MHI.

The Hoomalu zone landing per trip 2001 fell just short of last year by nearly 3%. The Hoomalu zone fleet maintained the same number and identity of vessels from the year 2000. The

Hoomalu zone fleet has had very stable participation and landings for the last 7-8 years.

Figure 3. NWHI BMUS species composition of landings by weight





Data table for Figure 3 (in thousands of pounds)

Species	1990	1991[1]	1992[1]	1993[1]	1994[1]	1995[1]	1996[2]	1997[2]	1998[2]	1999[2]	2000[2]	2001[2,3]
Opakapaka	79	86	145	158	145	105	79	109	87	77	53	67
Onaga	21	46	23	40	42	53	30	55	48	93	92	73
Ehu	25	20	8	11	15	8	17	15	17	17	13	14
Hapuupuu	85	59	57	59	68	54	49	57	70	59	23	31
Butaguchi	103	75	79	64	61	47	46	51	38	28	29	32
Uku	77	69	86	33	78	75	62	37	55	36	43	59
White ulua	9	12	12	5	10	5	13	5	5	3	2	6
Other BMUS	14	10	6	14	17	12	12	14	10	8	7	6

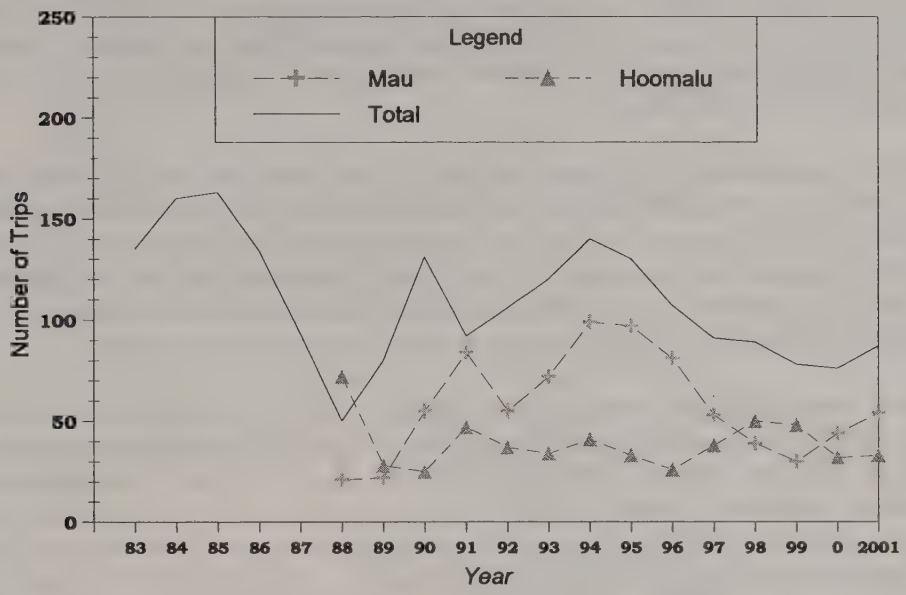
[1] Data from a combination of NMFS and HDAR data.
[2] Data from HDAR data set.
[3] 2001 data are a combination of HDAR data sets.

Source: Data for 1996-2000 is from the HDAR integrated data set. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program. Data from 1987-1990 are expanded NMFS estimates.

Calculation & Adjustment: The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

Comments & Interpretation: Overall landings are up for 2001. The majority of BMUS increased or maintained status quo with the exception of onaga which decreased nearly 21%. Ehu landings which are generally associated with those of the target species onaga (because of habitat/depth similarities) were nearly flat with only a slight increase. Opakapaka, hapuupuu, and butaguchi are likewise associated by habitat and depth requirements. This complex of landings are primarily driven by the targeting of opakapaka. Similarly uku and white ulua catches are related. The uku are targeted and the white ulua are also taken during the operations.

Figure 4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones



	Trips		
Year	Mau	Hoomalu	Total
1985	NA	NA	160
1986	NA	NA	163
1987	NA	NA	134
1988	21	72	93
1989	22	28	50
1990	55	25	80
1991[1]	84	47	131
1992[1]	55	37	92
1993[1]	72	34	106
1994[1]	99	41	140
1995[1]	97	33	130
1996[2]	81	26	107
1997[2]	53	38	91
1998[2]	39	50	89
1999[2]	30	48	78
2000[2]	47	36	83
2001[2,3]	**55**	**41**	**87**
mean	57.86	39.71	106.71
s.d.	25.70	12.14	31.29

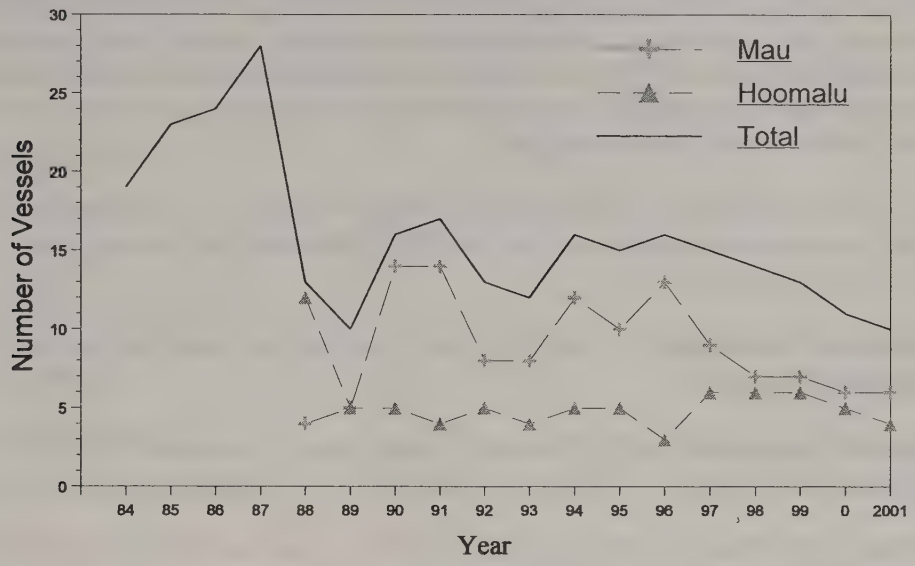
[1] Based on combined NMFS and HDAR data.
[2] Based on HDAR data.
[3] 2001 data are a combination of HDAR data sets.

Source: Data for 1996-2000 was from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1986-1990 are NMFS estimates. The data for 1995 have been updated. The trips were totaled by management area fished. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

Calculation & Adjustment: The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

Comments & Interpretation: Although the participant roster remained unchanged from 2000 to 2001 the number of trips made increased in both zones. The increase in the Hoomalu zone was due to 4 of the 5 vessels making more than the minimum number of trips to keep their permit active. In 2000 there were 2 vessels that made the 3 trip minimum. The Mau zone trip count varies as each operator makes the decision of what kind of fishing activity is most will be most successful at any given time. The Honolulu fleet which is mainly composed of full time bottomfish directed vessels did make more trips than in 2000 during which time a couple of vessels experienced equipment and crew problems.

Figure 5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones



	Boats		
Year	**Mau**	**Hoomalu**	**Total[2]**
1984	NA	NA	19
1985	NA	NA	23
1986	NA	NA	24
1987	NA	NA	28
1988	4	12	13
1989	5	5	10
1990	14	5	16
1991[1]	14	4	17
1992[1]	8	5	13
1993[1]	8	4	12
1994[1]	12	5	16
1995[1]	10	5	15
1996[3]	13	3	16
1997[3]	9	6	15
1998[2]	7	6	13
1999[3]	7	6	13
2000[3]	6	5	11
2001[3]	**6**	**5**	**11**
mean	8.79	5.43	15.83
s.d.	3.33	2.06	4.89

[1] Based on a combination NMFS and HDAR data set.
[2] Total may not match sum of areas due to vessel participation in multiple areas.
[3] Based on HDAR data.

Source: The majority of the 2001 data were from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Some of the data for 2001 were from the HDAR dealer data reporting system. Other supplementary collection of data by both HDAR and NMFS at the Honolulu fish auction provides opportunities for the cross-checking of trip and landing information. The detailed information collected at the Honolulu auction is used for other analysis.

Data for 1996-2000 was from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1984-1990 are NMFS estimates.

Calculation & Adjustment: The number of active participating vessels were totaled by year and management zone.

Comments & Interpretation: The number of active vessels is identical to that of 2000. All of the participating vessels from 2000 did participate in the 2001 fishery.

In 1996 due to fishermen's economic concerns, the Mau Zone Task Force was formed to address the problem and suggest possible solutions. The Task Force moved in the direction of a limited entry fishery much like the Hoomalu zone and the subsequent 1997 moratorium on additional new participants essentially capped the fleet pending new regulations. The moratorium itself had reduced the number of vessels from 13 in 1996 to 9 in 1997 to 7 in 1998. The new limited entry regulations and its initial qualification criteria were put into effect in mid-1999. It allows all qualifying participants initial entry after which a "use it or lose it" criteria would allow the managers to reduce the fleet to its target number. The assumption that the number of initial entrants would be large was unfounded as there was less interest than expected. It was expected that fleet size reduction would occur rapidly as the Mau zone has historically had a large turnover in annual participation. In 2000 the number of active participants decreased by 1 in each zone. The Mau zone has lost a dedicated full-time bottomfish fisherman. The Hoomalu zone has lost a part-time bottomfish fisherman.

Table 1. NWHI 2001 Bycatch by Species

Pelagic MUS	# released	total # sold	% bycatch by species	% bycatch/ total # sold
YF tuna (T. albacares)	3	1070	<1 %	<1%
BE tuna (T. obesus)	20	27	43 %	<1%
Kawakawa (E. affinis)	1	108	1 %	<1%
Striped marlin (T. audax)	1	3	25 %	<1%
Shark (unidentified)	89	0	100 %	<1%
Tiger shark (G. cuvieri)	4	0	100 %	<1%
White-tipped shark (unidentified)	1	0	100 %	<1%

Bottomfish MUS	# released	total # sold	% bycatch by species	% bycatch/ total # sold
Onaga (E. coruscans)	1	8582	<1 %	<1%
Opakapaka (P. filamentosus)	1	7931	<1 %	<1%
Ehu (E. carbunculus)	8	3900	<1 %	<1%
Uku (A. virescens)	3	5538	<1 %	<1%
Kalekale (P. sieboldii)	265	2026	12 %	<1%
Butaguchi (P. dentex)	777	2314	25 %	2%
White Ulua (C. ignobilis)	532	251	68 %	1%
Kahala (Seriola spp.)	4013	0	100 %	11%

Miscellaneous species	# released	total # sold	% bycatch by species	% bycatch/ total # sold
Omilu (C. melampygus)	71	57	55 %	<1%
Papa ulua (C. orthogrammus)	4	52	7 %	<1%

Table 2. Mau Zone Bycatch by Species, 2001

R = # released, S = # sold, % bycatch within species={R/(R+S)}*100
% bycatch within species groups=(R/R+S by species group)*100

% bycatch per total catch=(R/total R+S)*100

Pelagic MUS	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
YF tuna (T. albacares)	0	794	0 %	0 %	0 %
BE tuna (T. obesus)	20	0	100 %	2 %	< 1%
Kawakawa (E. affinis)	0	67	0 %	0 %	0 %
Striped marlin (T. audax)	1	2	33 %	< 1%	< 1%
Shark (unidentified)	55	0	100 %	6 %	< 1%
Tiger shark (G. cuvieri)	1	0	100 %	< 1%	< 1%
White-tipped shark (unidentified)	1	0	100 %	< 1%	< 1%

Bottomfish MUS	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
Onaga (E. coruscans)	1	481	<1 %	<1 %	< 1%
Opakapaka (P. filamentosus)	0	421	0 %	0 %	0 %
Ehu (E. carbunculus)	8	1910	<1 %	<1 %	< 1%
Uku (A. virescens)	0	1541	0 %	0 %	0 %
Kalekale (P. sieboldii)	1	1207	<1 %	<1 %	< 1%
Butaguchi (P. dentex)	10	687	1 %	<1 %	< 1%
White Ulua (C. ignobilis)	0	19	0 %	0 %	0 %
Kahala (Seriola spp.)	653	0	100 %	9 %	8 %

Miscellaneous species	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
Omilu (C. melampygus)	30	48	38 %	28%	< 1%
Papa ulua (C. orthogrammus)	0	29	0 %	0 %	0 %

Table 3. Hoomalu Zone Bycatch by Species, 2001

R = # released, S = # sold, % bycatch within species={R/(R+S)}*100
% bycatch within species groups=(R/R+S by species group)*100

% bycatch per total catch=(R/total R+S)*100

Pelagic MUS	# released	total # sold	% bycatch within species	% bycatch within species groups	% bycatch per total catch
YF tuna (T. albacares)	3	276	1 %	<1 %	< 1%
BE tuna (T. obesus)	0	27	0 %	0 %	0 %
Kawakawa (E. affinis)	1	41	0 %	<1 %	< 1%
Striped marlin (T. audax)	0	1	0 %	0 %	0 %
Shark (unidentified)	34	0	100 %	<1 %	< 1%
Tiger shark (G. cuvieri)	3	0	100 %	<1 %	< 1%
White-tipped shark (unidentified)	0	0	0 %	0 %	0 %

Bottomfish MUS	# released	total # sold	% bycatch by species	% bycatch within species groups	% bycatch per total catch
Onaga (E. coruscans)	0	8101	0 %	0 %	0 %
Opakapaka (P. filamentosus)	1	7510	<1 %	<1 %	< 1%
Ehu (E. carbunculus)	0	1990	0 %	0 %	0 %
Uku (A. virescens)	3	3997	<1 %	<1 %	< 1%
Kalekale (P. sieboldii)	264	819	24 %	1 %	< 1%
Butaguchi (P. dentex)	767	1627	32 %	3 %	3 %
White Ulua (C. ignobilis)	532	232	70 %	2 %	2 %
Kahala (Seriola spp.)	3360	0	100 %	12 %	11 %

Miscellaneous species	# released	total # sold	% bycatch by species	% bycatch within species groups	% bycatch per total catch
Omilu (C. melampygus)	41	9	82 %	< 1%	< 1%
Papa ulua (C. orthogrammus)	4	23	15 %	< 1%	< 1%

Source: The 2001 bycatch data were from HDAR's integrated data set which combines the NWHI daily logs and the sales report. The bycatch data are recorded on the daily logs and are filled in on a daily basis by the fishermen while at sea. The species that are listed here are only those that were identified on the daily logs that were released therefore it is not a complete list of all species caught or sold.

Calculation & Adjustment: The bycatch percentage was calculated by dividing the number of released fish by the sum of the number of sold fish plus the number of released. The number of sold fish does not equal the total catch but does represent a verifiable number of fishes taken. The numbers of fish that are retained but not sold, ie. eaten or given away, is believed to be very few compared to the total number sold. The release category does not specify whether the fish was released alive or released dead.

The data consists of the reported releases from all of the daily log sheets for NWHI fishing trips that were submitted. All fishing trips (including main Hawaiian island areas or other areas) made by the permitted fishing vessels are reported to the State under this reporting system. Only the information on trips made to the NWHI which landed bottomfish management unit species, regardless of gear type or fishing method, were included in the data set. Nearly 100% of the NWHI fishing trips were accounted for by the HDAR reporting system. There were no adjustments made for data from any missing or unreported trips.

Comments & Interpretation: The identification of the species and number of fishes that were released indicates that the majority of the released fish would fall into the category of economic or regulatory discards. Since the State of Hawaii instituted regulations to control the practice of shark finning by requiring that the entire carcass be brought to shore along with the fins the NWHI bottomfishermen have been releasing all of the sharks that they have caught. Previous to the implementation of the new shark carcass retention regulation a small percentage of the sharks were retained by a few vessels due to the high value of their fins. Although the value of the shark fins are high the income generated could not offset the costs of lost and damaged equipment and the loss of catch that can be directly attributed to sharks. The percentage of live verses dead releases under the present regulations are not known. Sharks constitute the major regulatory discard for this fishery.

The economic discards are mainly constituted of species which have low or in some cases no commercial value. Bottomfish management unit species as well as pelagic management unit species and miscellaneous other species are released. Releases are generally prompted by product shelf-life concerns(due to trip length), low value, or concern for future resources(release of small fish). The fishermen are making an effort to minimize some economic liability by live releasing "low value" fish early in the trip and retaining them later during the trip to obtain the maximum value.

Conservation or stock related releases are another component of the release strategy employed by the fishermen. The NWHI fishermen have been live releasing a low number of small sized high

value BMUS species such as onaga, opakapaka, ehu, and uku. Large numbers of various commercially low valued species(ie., butaguchi, kalekale, and white ulua) are also released live in an effort to reduce/minimize any waste of fishery resources.

Releases of fishes by management area presents patterns that reflect the fisheremen's strategy for maximizing their profits. In the Mau zone where the trip lengths and distances to markets are short and hold space is not a limiting factor most of the fish caught are retained for sale regardless of their short shelf-life or low-value. The Hoomalu zone presents more of a challenge to the fishermen to try to maximize their profitability on these long trips. The maximizing of hold space and the ice capacity make this a tricky balancing act. Hold space is primarily reserved for high valued species. The shelf-life concerns for various species are addressed by releasing the species early on in the trip and retaining them during the latter stages of the trip to maximize the returns on the fresher product. This strategy lessens waste(by live releases) and maximizes economic profits(fresher product) while conserving the limited bottomfish resources. Additionally the fresher appearance of the fish put up for sale usually increases the price paid and enhances the reputation of the fisherman as being quality conscious and bringing in a top quality product.

Tha largest component of the releases is that of kahala, *Seriola* spp. The kahala was once a very important commercial species but due to the presence of ciguatoxin in a percentage of fish it has not been sold for many years due to liability concerns. It is thought that since kahala are caught in such large numbers while fishing for the targeted species their population represent competition for food and habitat resources. The large kahala are also known to feed on the valuable bottomfish species, often stealing them off the hooks and thus contributing to the inefficiencies of the fishing operations as well. The fishermen release the majority of kahala that they catch although they may from time to time use them as bait or chum. The releases can be either live or dead depending on the preference of the captain. The percentage of live releases to dead releases are not known. Many of the NWHI captains voluntarily participate in the State of Hawaii's ulua tagging study and routinely tag many kahala and other jacks.

Figure 6. MHI species composition of landings by weight

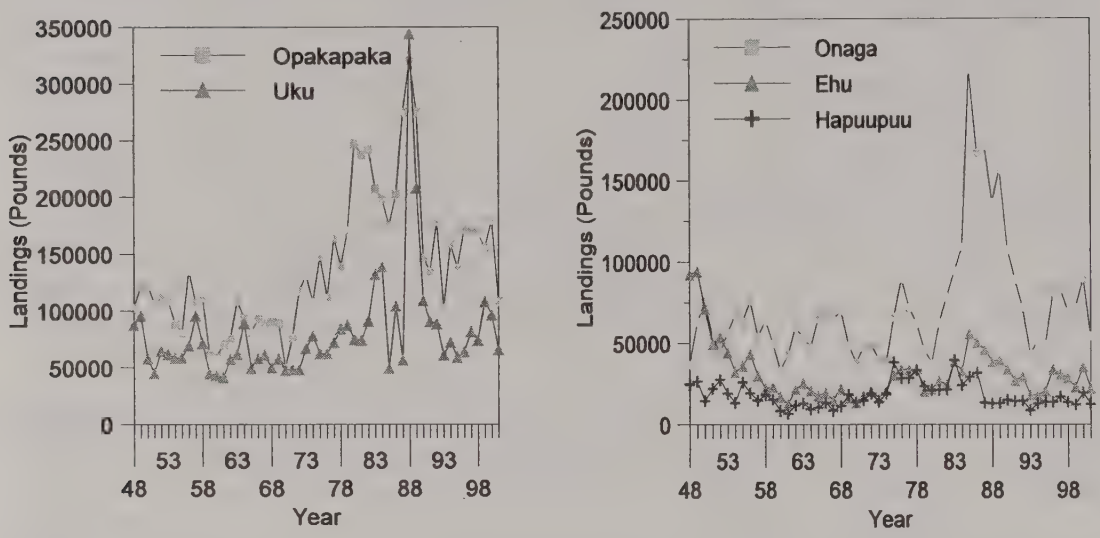


Figure 2

Interpretation: Most species show declining trends from the mid- and late-eighties to 1993 then increases to date. The prevailing interannual pattern in landings is episodic versus predictably periodic or constant. 2001 landings for all species are preliminary as they are based on catch reports submitted to date. Data from earlier years is essentially complete. Landings for all species were highest in the mid 1980s.

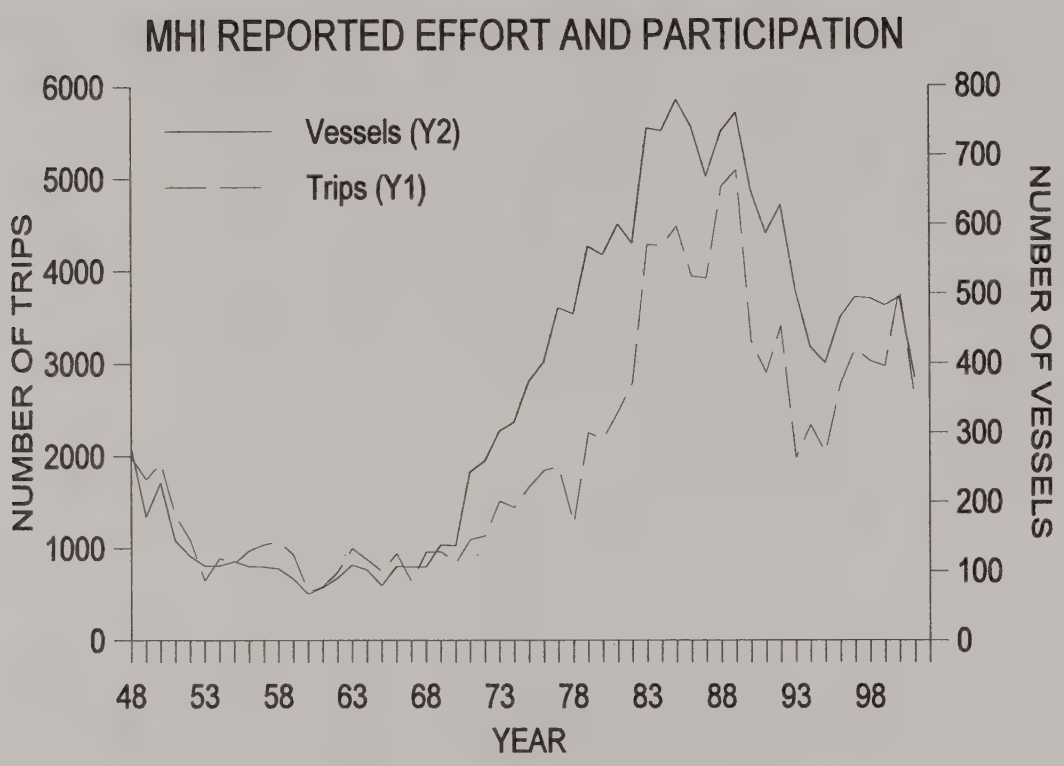
Source: Total commercial landings by species are from HDAR commercial catch report data for the MHI with no screening by gear. 2000 values have been updated from last year's report with an essentially complete data set for that year. 2001 values are preliminary estimates of annual landings based on landings reported to date and should increase for all species by an unknown amount.

Comments: Landings presented here are commercial reported landings only and do not include any expansion for recreational landings.

MHI Landings by Species

YEAR	OPA	ONA	EHU	UKU	HAP
1948	102651	36804	92323	87235	24609
1949	121243	62979	94097	95273	26397
1950	121664	75398	71286	57814	14514
1951	106423	53018	49699	45065	22000
1952	112917	44604	53716	64799	27499
1953	108504	56506	44200	61619	19009
1954	88641	67583	32278	58767	13367
1955	80516	63208	36017	58564	25849
1956	134980	75986	43313	69108	19224
1957	106656	53988	30157	95267	14782
1958	111131	63774	22309	71321	18033
1959	62043	49745	23107	44705	15294
1960	59405	33158	16950	43186	8418
1961	70083	42701	12370	41134	6642
1962	75492	59788	21742	57568	11663
1963	108505	53225	25267	61601	12865
1964	93618	47325	20914	89156	9321
1965	81039	65040	17605	49485	10297
1966	92815	69634	19342	57849	13277
1967	89364	64022	14899	60970	8480
1968	89908	69922	21984	49677	11287
1969	88621	48454	16483	57542	18300
1970	49655	37894	13364	47443	13651
1971	76388	47250	17626	48710	14746
1972	117367	49213	20347	48077	18994
1973	130785	39811	16336	66875	13878
1974	107828	38883	21015	77939	18874
1975	147755	66029	30155	62117	38140
1976	111520	89518	33788	62165	28214
1977	163813	71747	33689	71915	28540
1978	138931	62208	34333	83798	33271
1979	170180	46271	20339	87128	23538
1980	247378	37489	21712	74782	20962
1981	237254	62351	26900	73921	21178
1982	241977	78372	24542	90793	21263
1983	207345	94082	38793	131860	39447
1984	198260	109046	33022	138313	24019
1985	174746	218552	56039	49264	29055
1986	202467	167112	50259	104047	31626
1987	274929	171416	46018	56753	13232
1988	320601	136641	38547	344128	12838
1989	275167	156952	39393	208171	12954
1990	146861	107514	33848	108840	14934
1991	134326	88978	26902	90272	14216
1992	178014	71715	29461	88474	14454
1993	102514	43141	17981	60910	8593
1994	158276	51502	18000	72133	12712
1995	137473	48948	20689	59036	13819
1996	171428	80953	33925	63792	13723
1997	172308	82874	30778	81367	16984
1998	167918	69077	28417	73724	13610
1999	155300	71749	23009	107826	12080
2000	179172	89431	35368	96012	19420
2001	**108089**	**54232**	**22160**	**65634**	**12431**
mean	139116	72182	31793	79147	18084
s.d.	59843	36988	17149	46389	7566

Figure 7. MHI reported effort and participation



Interpretation: Preliminary 2001 values for effort and participation are based on reports received to date and not expanded for any late reporting. Participation indicated to date suggest a sharp decline in participation and effort from 2000. These values are apt to increase with more complete reporting, but are not apt to reach 2000 levels.

Landings and CPUE for bottomfish trips are tabulated in the following table. These figures differ from those presented in Figure 1 (landings) and Figure 14 (CPUE). Those presented here are screened for bottomfish trips only (as defined below). In Figure 1 landings are for bottomfish species caught on all gears without screening criteria and in Figure 14 data are further screened by area fished and landings of individual fishers to reflect the effective fishing effort required to "standardize" CPUE. Landings in 2001 are below the 2000 values and the long-term average, and the CPUE value is the lowest on record.

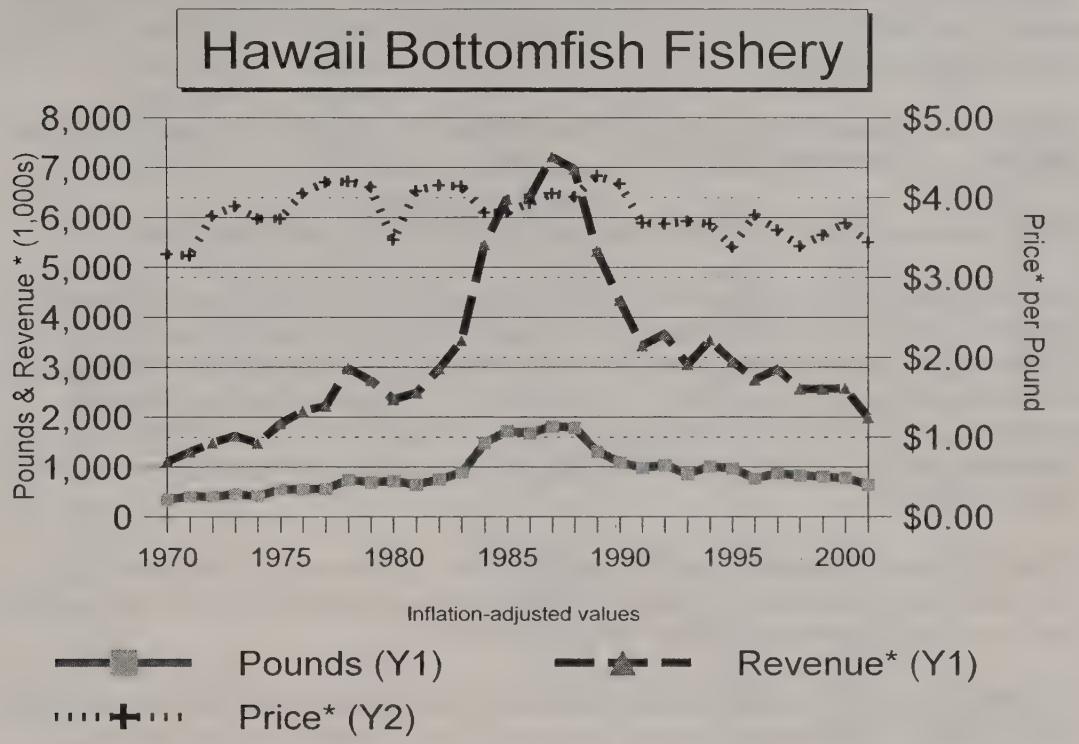
Source: HDAR commercial catch report data.

Calculation & Adjustment: MHI commercial bottomfish trip and vessel values are obtained

from the HDAR C3 report data. Participation (# of vessels) is presented as the number of unique license numbers reporting bottomfishing trips for a particular year. For 1948-1993 the reported value for participation is based on the State fiscal year (July-June). For 1994-1999 the participation is reported on a calendar year basis. Trips qualify as bottomfish trips if they use bottomfish handline gear and at least 90% of the catch is of BMUS species.

Yr	#Ves	#Trip	Tot.Lbs	Lbs/Trip
48	207	1987	323858	162.99
49	196	1751	338406	193.26
50	164	1924	302137	157.04
51	126	1355	282271	208.32
52	110	1091	232235	212.86
53	106	650	123867	190.56
54	103	894	233557	261.25
55	108	836	197757	236.55
56	106	975	257183	263.78
57	102	1041	239485	230.05
58	96	1075	238138	221.52
59	76	929	213322	229.63
60	69	527	148339	281.48
61	65	586	171768	293.12
62	98	742	219203	295.42
63	110	1001	290690	290.40
64	87	876	297039	339.09
65	85	750	237624	316.83
66	97	940	274293	291.80
67	99	641	236588	369.09
68	116	959	252305	263.09
69	130	964	232754	241.45
70	219	841	169792	201.89
71	198	1093	173001	158.28
72	185	1135	194967	171.78
73	238	1511	246341	163.03
74	241	1442	218750	151.70
75	295	1664	322986	194.10
76	306	1845	301071	163.18
77	377	1881	323991	172.24
78	414	1268	272620	215.00
79	423	2251	316132	140.44
80	461	2181	372369	170.73
81	430	2481	392205	158.08
82	526	2790	432259	154.93
83	541	4283	484603	113.15
84	558	4272	428608	100.33
85	583	4481	476457	106.33
86	538	3939	476745	121.03
87	535	3920	475313	121.25
88	572	4911	687379	139.97
89	537	5091	634691	124.67
90	501	3242	338401	104.38
91	469	2895	285046	98.46
92	407	3401	329024	96.74
93	403	1977	199023	100.67
94	423	2333	226436	97.06
95	400	2031	194828	95.93
96	466	2780	253887	91.33
97	495	3158	288107	91.23
98	493	3023	268607	88.85
99	483	2970	261148	87.92
2000	495	3810	310817	81.58
2001	**379**	**2593**	**191027**	**73.67**
mean	297	2037	294249	179.62
s.d.	180	1254	112271	75.93

Figure 8. Hawaii bottomfish landings, revenues, prices, 1970 - present. (* Inflation-adjusted)



Interpretation*: After twenty years of growth, Hawaii bottomfish landings and *real* (inflation-adjusted) revenue peaked in 1987 and have declined by 50% and 60%, respectively, in the almost fifteen years since then. Much of this decline has been caused by reductions in fishing participation (vessels and trips) due to limited entry and to a weak market for fresh bottomfish in the 1990s.

There is no particular patter for inflation-adjusted ex-vessel bottomfish prices. Previous economic research (mid-1980s) showed a strong inverse relationship between monthly and weekly price and landings, but this relationship appears weaker in the 1990s, perhaps due to increased imports of bottomfish from Pacific island nations. On an annual basis, this relationship is not seen at all. Changes in area and species composition may also be changing the aggregate price (discussed later in the report).

Of particular importance in interpreting bottomfish price trends, which strongly influence the economic performance of bottomfish vessels, is the increasing presence of imported bottomfish (snappers) in the Hawaii market. According to U.S. Customs data for the Port of Honolulu,

575,000 pounds of snapper were imported in CY 2000 worth $1.7 million ($2.96 per pound). This amounts to roughly two thirds of domestic supply and thus a signficant factor in ex-vessel prices. Tonga and Australia were the largest sources of fresh snapper, with Fiji and New Zealand also being major sources.

*Note: Interpretation of this figure has not been updated for 2001 data. The interpretation will be updated in the 2002 annual report.

Data: "Landings" refer to Pounds Caught (vs. Pounds Sold). Revenue is ex-vessel.

Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83 although there may be problems of under-reporting during the latter part of that period[1]. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984 - 1990. Data from 1991 - 1997 use a combination of HDAR figures and NMFS adjustments, while data for 1998 - present are solely from HDAR data.

HDAR MHI data for calendar year 2000 are preliminary, representing approximately 85% of anticipated reports for all gears, all species. NWHI data are considered complete due to a fast-track system which includes NMFS shoreside monitoring.

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI), `983-84 baseline; revenue* and prices* are adjusted to the current year.

Data source: Data imported from HTOT00x.xls (4/12/01)

Note: Main Hawaiian Islands data for 2000 are preliminary in this report.

---

[1] The likelihood of that under-reporting is shown by the "jump" in NWHI landings when the Western Pacific Regional Fishery Management Council (and subsequently in 1987 NMFS) shoreside monitoring program began in 1984, with 38,000 pounds reported landed by the State in 1983 and 661,000 pounds reported landed by the Council in 1984. NWHI reported NWHI landings to HDAR in 1984 were 224,000 pounds.

Hawaii bottomfish landings, revenue, and price, 1970 - present. (* Inflation-adjusted.)

	Pounds Caught All Areas (1,000s)	Revenue All Areas ($1,000)	Revenue* (Inflation-adjusted)	Price[2] Per Pound Sold	Price * (Inflation-adjusted)	HCPI
1970	344	$253	$1,104	$0.76	$3.29	40.9
1971	410	$312	$1,307	$0.78	$3.27	42.6
1972	407	$366	$1,484	$0.93	$3.77	44.0
1973	454	$418	$1,625	$1.00	$3.89	45.9
1974	413	$421	$1,478	$1.06	$3.73	50.8
1975	549	$584	$1,877	$1.16	$3.73	55.5
1976	558	$693	$2,121	$1.33	$4.05	58.3
1977	562	$764	$2,227	$1.44	$4.19	61.2
1978	740	$1,100	$2,978	$1.55	$4.20	65.9
1979	698	$1,123	$2,737	$1.69	$4.13	73.2
1980	713	$1,082	$2,357	$1.59	$3.47	81.9
1981	643	$1,262	$2,488	$2.07	$4.08	90.5
1982	750	$1,600	$2,973	$2.23	$4.15	96.0
1983	887	$1,976	$3,532	$2.31	$4.14	99.8
1984	1,481	$3,192	$5,460	$2.23	$3.81	104.3
1985	1,717	$3,853	$6,370	$2.31	$3.81	107.9
1986	1,682	$3,958	$6,402	$2.43	$3.93	110.3
1987	1,819	$4,687	$7,215	$2.63	$4.05	115.9
1988	1,794	$4,796	$6,967	$2.76	$4.01	122.8
1989	1,314	$3,867	$5,319	$3.10	$4.27	129.7
1990	1,094	$3,371	$4,330	$3.24	$4.17	138.9
1991	984	$2,864	$3,431	$3.07	$3.68	148.9
1992	1,043	$3,199	$3,661	$3.21	$3.67	155.9
1993	862	$2,749	$3,052	$3.33	$3.70	160.7
1994	1,011	$3,277	$3,550	$3.39	$3.67	164.7
1995	972	$2,949	$3,124	$3.19	$3.38	168.4
1996	768	$2,636	$2,750	$3.62	$3.78	171.0
1997	872	$2,855	$2,958	$3.47	$3.59	172.2
1998	834	$2,470	$2,568	$3.26	$3.39	171.6
1999	801	$2,496	$2,568	$3.43	$3.53	173.4
2000	781	$2,550	$2,580	$3.64	$3.68	176.3
2001p	643	$1,993	$1,993	$3.44	$3.44	178.4
Average	894	$2,179	$3,268	$2.36	$3.80	111.81
Standard Deviation	411	$1,337	$1,644	$0.95	$0.28	47.60

[2] Price calculated on Pounds Sold (not shown), not Pounds Caught.

Figure 9. Hawaii bottomfish landings, revenue*, and price* by source, 1970 - present. (*Inflation adjusted)

Interpretation*: Inflation-adjusted revenue from main Hawaiian Islands bottomfish grew steadily through the 1970s and 1980s as both *real* prices and total landings increased substantially. Beginning in 1988, total landings began to decline, falling almost 60% in the subsequent decade, while inflation-adjusted prices have been variable, showing no particular trend although remaining substantially above the long-term average. NWHI bottomfish landings also grew dramatically in the mid-1980s and then tailed off, stabilizing in the 1990s at a level below the main Hawaiian Islands. Inflation-adjusted revenue is only 25% that in 1987 (the peak).

These changes in total landings are related to both catch rates and participation. More interpretation can be gleaned from discussion in detailed tables and figures in this report.

*Note: Interpretation of this figure has not been updated for 2001 data. The interpretation will be updated in the 2002 annual report.

Data: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings from 1997 to present.

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI); revenue* and prices* are adjusted to the current year.

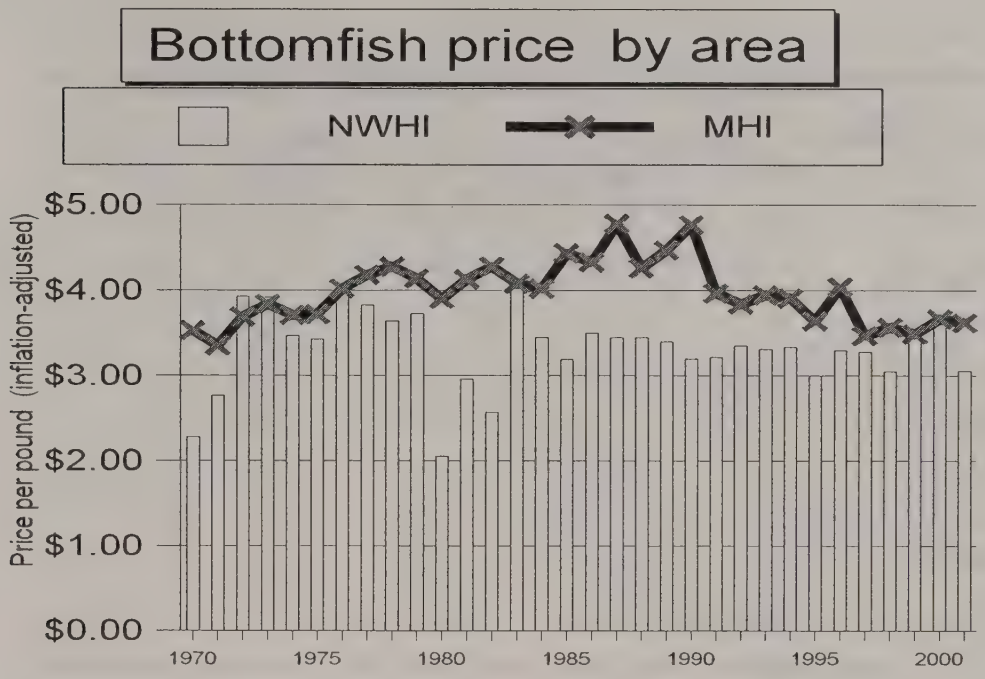
Data source: Data imported from HTOT00x.xls (4/12/01)

Hawaii bottomfish landings, revenue, and price by source, 1970 - present.
(* Inflation-adjusted.)

	NWHI Pounds Caught	NWHI Revenue	NWHI Revenue*	NWHI Aggregate	NWHI Aggregate Price *	HCPI
		Nominal Values	(Inflation-adjusted)	Nominal Price	(Inflation-adjusted)	
1970	74	$39	$170	$0.53	$2.31	40.9
1971	75	$50	$209	$0.67	$2.81	42.6
1972	43	$42	$170	$0.98	$3.97	44.0
1973	62	$63	$245	$1.02	$3.96	45.9
1974	49	$49	$172	$1.00	$3.51	50.8
1975	59	$64	$206	$1.08	$3.47	55.5
1976	59	$78	$239	$1.32	$4.04	58.3
1977	83	$104	$303	$1.33	$3.88	61.2
1978	143	$194	$525	$1.36	$3.68	65.9
1979	118	$183	$446	$1.55	$3.78	73.2
1980	172	$163	$355	$0.95	$2.07	81.9
1981	52	$79	$156	$1.52	$3.00	90.5
1982	77	$108	$201	$1.40	$2.60	96.0
1983	38	$89	$159	$2.34	$4.18	99.8
1984	661	$1,350	$2,309	$2.04	$3.49	104.3
1985	922	$1,800	$2,976	$1.95	$3.22	107.9
1986	869	$1,900	$3,073	$2.19	$3.54	110.3
1987	1015	$2,300	$3,540	$2.27	$3.49	115.9
1988	625	$1,500	$2,179	$2.40	$3.49	122.8
1989	303	$756	$1,040	$2.50	$3.44	129.7
1990	423	$1,066	$1,369	$2.52	$3.24	138.9
1991	387	$1,053	$1,262	$2.72	$3.26	148.9
1992	424	$1,255	$1,436	$2.96	$3.39	155.9
1993	385	$1,164	$1,292	$3.02	$3.35	160.7
1994	443	$1,382	$1,497	$3.12	$3.38	164.7
1995	369	$1,060	$1,123	$2.87	$3.04	168.4
1996	309	$989	$1,032	$3.20	$3.34	171.0
1997	346	$1,106	$1,146	$3.20	$3.32	172.2
1998	329	$924	$961	$2.97	$3.09	171.6
1999	341	$1,102	$1,134	$3.42	$3.52	173.4
2000	270	$902	$913	$3.68	$3.72	176.3
2001p	**251**	**$725**	**$725**	**$3.10**	**$3.10**	**178.4**
Average	306	$739	$1,018	$2.10	$3.37	111.8
Standard Deviation	265	$645	$911	$0.90	$0.46	47.60

	MHI Pounds Caught	MHI Revenue	MHI Revenue* (Inflation-adjusted)	MHI Aggregate Price	MHI Aggregate Price * (Inflation - adjusted)	HCPI
1970	270	$214	$933	$0.82	$3.58	40.9
1971	335	$262	$1,097	$0.81	$3.39	42.6
1972	364	$324	$1,314	$0.92	$3.73	44.0
1973	392	$355	$1,380	$1.00	$3.89	45.9
1974	364	$372	$1,306	$1.07	$3.76	50.8
1975	485	$513	$1,649	$1.17	$3.76	55.5
1976	499	$615	$1,882	$1.33	$4.07	58.3
1977	479	$660	$1,924	$1.45	$4.23	61.2
1978	597	$906	$2,453	$1.60	$4.33	65.9
1979	580	$940	$2,291	$1.72	$4.19	73.2
1980	541	$919	$2,002	$1.81	$3.94	81.9
1981	591	$1,183	$2,332	$2.12	$4.18	90.5
1982	673	$1,492	$2,773	$2.33	$4.33	96.0
1983	847	$1,882	$3,364	$2.31	$4.13	99.8
1984	803	$1,797	$3,074	$2.38	$4.07	104.3
1985	765	$1,954	$3,231	$2.72	$4.50	107.9
1986	811	$2,052	$3,319	$2.71	$4.38	110.3
1987	785	$2,345	$3,610	$3.14	$4.83	115.9
1988	1,166	$3,288	$4,777	$2.97	$4.31	122.8
1989	1,007	$3,090	$4,250	$3.29	$4.53	129.7
1990	651	$2,242	$2,880	$3.76	$4.83	138.9
1991	562	$1,713	$2,052	$3.35	$4.01	148.9
1992	588	$1,842	$2,108	$3.40	$3.89	155.9
1993	462	$1,535	$1,704	$3.60	$4.00	160.7
1994	536	$1,793	$1,942	$3.65	$3.95	164.7
1995	570	$1,818	$1,926	$3.48	$3.69	168.4
1996	442	$1,593	$1,662	$3.92	$4.09	171.0
1997	519	$1,589	$1,646	$3.39	$3.51	172.2
1998	496	$1,517	$1,577	$3.47	$3.61	171.6
1999	460	$1,393	$1,433	$3.43	$3.53	173.4
2000	509	$1,641	$1,661	$3.67	$3.71	176.3
2001p	**391**	**$1,266**	**$1,266**	**$3.66**	**$3.66**	**178.4**
Average	588	$1,407	$2,263	$2.44	$4.04	107.4
Standard Deviation	197	$787	$924	$1.02	$0.36	45.95

Figure 10. Hawaii bottomfish ex-vessel prices* by source, 1987 - present.
(* Inflation-adjusted.)

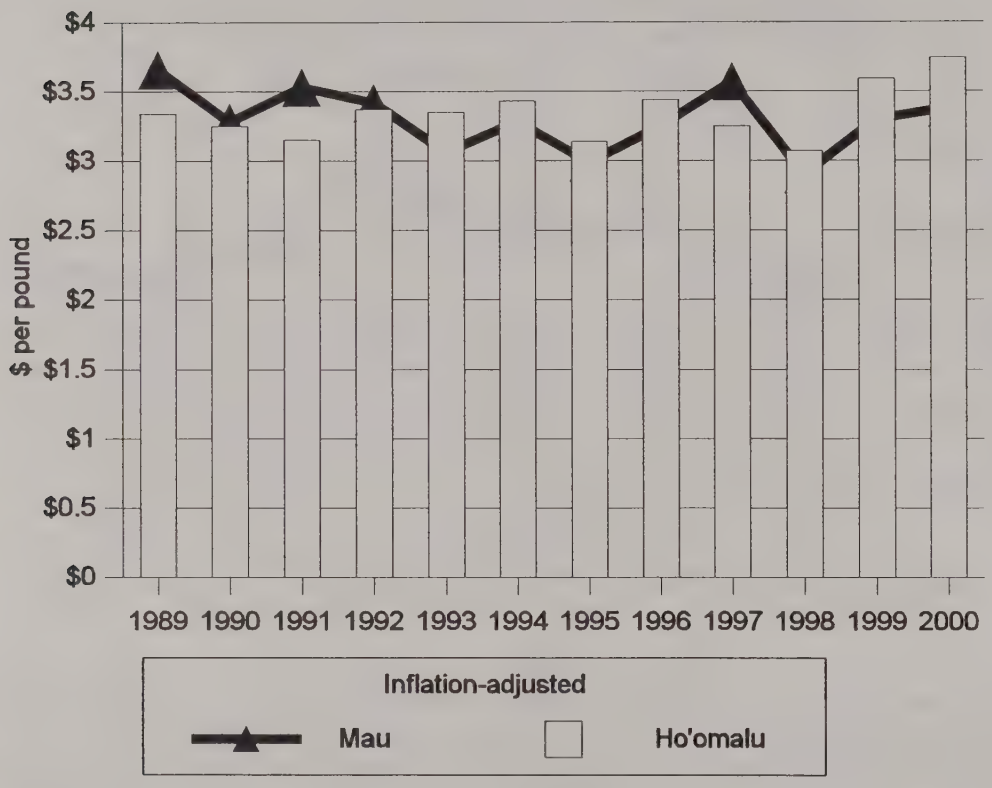


Interpretation*: Historically, bottomfish caught in the main Hawaiian Islands have tended to have higher aggregate prices, reflecting both species composition and greater freshness. However, in the late 1990s, the prices converged. This might have reflected a relative lowering of the MHI bottomfish prices, perhaps reflecting the softness of the upscale part of the Hawaii market. Onaga and opakapaka comprise the largest valued landings in each area for most years (ignoring the highly fluctuating landings of uku); NWHI ex-vessel prices were $4.35 and $4.40 per pound respectively in CY 2000 while MHI were $5.93 and $ 4.46, respectively. However, the NWHI landings are comprised of a higher percentage of these higher priced species compared to the MHI, so the difference in price for individual species by area is ironed out by the different species compositions between the two areas.

*Note: Interpretation of this figure has not been updated for 2001 data. The interpretation will be updated in the 2002 annual report.

Data: See Figure 9.

Figure 11. Hawaii Bottomfish (BMUS) Ex-vessel Prices* by NWHI zone, 1989 - present (* Inflation-adjusted).



Interpretation*: Mau and Ho'omalu zone aggregate bottomfish prices (not accounting for differences in species composition) have been roughly the same in aggregate over time but diverged rather substantially in recent years, with the Ho'omalu receiving the highest aggregate prices. In inflation-adjusted terms, Mau zone prices have not changed substantial over the past ten years but Ho'omalu zone aggregate prices are 15 - 20% higher than in the late 1980s and early 1990s. On an individual species basis, Mau zone prices exceed those for the Ho'omalu zone, which might be expected since there is a shorter running time from the Mau zone to markets on Oahu and Kauai. Onaga and opakapaka are respectively $5.82 and $4.31 per pound, ex-vessel, from the Mau zone, while from the Ho'omalu zone the prices are $4.31 and $4.36.

*Note: Interpretation of this figure has not been updated for 2001 data. The interpretation will be updated in the 2002 annual report.

Hawaii Bottomfish Ex-vessel Prices* by NWHI zone, 1989 - present.
(*Inflation-adjusted to current year base)

	Nominal Price per Pound		Inflation-adjusted Price		
Year	**Mau**	**Ho'omalu**	**Mau**	**Ho'omalu**	**HCPI**
1989	$2.64	$2.41	$3.63	$3.31	129.70
1990	$2.53	$2.51	$3.25	$3.22	138.90
1991	$2.92	$2.61	$3.50	$3.13	148.90
1992	$2.96	$2.92	$3.39	$3.34	155.90
1993	$2.73	$2.99	$3.03	$3.32	160.70
1994	$3.00	$3.14	$3.25	$3.40	164.70
1995	$2.80	$2.94	$2.97	$3.11	168.40
1996	$3.09	$3.27	$3.22	$3.41	171.00
1997	$3.42	$3.11	$3.54	$3.22	172.20
1998	$2.77	$2.93	$2.88	$3.05	171.6
1999	$3.18	$3.46	$3.27	$3.56	173.4
2000	$3.38	$3.74	$3.42	$3.78	176.3
2001p	**$2.79**	**$3.15**	**$2.79**	**$3.15**	**178.4**
Average	$2.94	$3.01	$3.24	$3.31	162.32
Standard Deviation	$0.27	$0.37	$0.26	$0.20	**15.04**

Data: NWHI prices are compiled from NMFS market monitoring landings. Inflation-adjusted values are to current year base HCPI (Honolulu Consumer Price Index).

Data source: nwhi2000.xls (4/9/01)

Hawaii bottomfish species landings and prices, all areas combined, 2000 & 2001.[3]

	2000		2001	
	Pounds	**Revenue**	**Pounds**	**Revenue**
Butaguchi	38,380	60,715	31,228	49,224
Ehu	43,057	155,538	37,503	126,843
Hapuupuu	41,430	141,534	37,437	133,846
Onaga	169,306	812,297	128,414	569,700
Opakapaka	206,767	857,340	156,416	653,372
Uku	122,990	298,457	117,280	266,732
Ulua	6,698	7,985	7,862	10,198
Other BMUS	117,592	156,144	92,963	124,466
Other Bottomfish	35,158	60,445	33,518	59,056
Total Bottomfish	781,378	2,550,455	642,621	1,993,437

	Average Ex-vessel Price per Pound	
	2000	2001
Butaguchi	$1.82	$1.73
Ehu	$3.89	$3.69
Hapuupuu	$3.60	$3.78
Onaga	$5.05	$4.67
Opakapaka	$4.43	$4.41
Uku	$2.58	$2.43
Ulua	$1.41	$1.48
Other BMUS	$1.86	$1.82
Other Bottomfish	$2.22	$2.20
Total Bottomfish	$3.64	$3.43

Interpretation*: Species prices show the significance of species composition in aggregate statistics since prices vary from $5.05 per pound, ex-vessel, for onaga to $1.88 for "other" BMUS (bottomfish management unit species). The generally higher species prices in 2000

[3] Small differences may exist between species totals and area totals due to rounding.

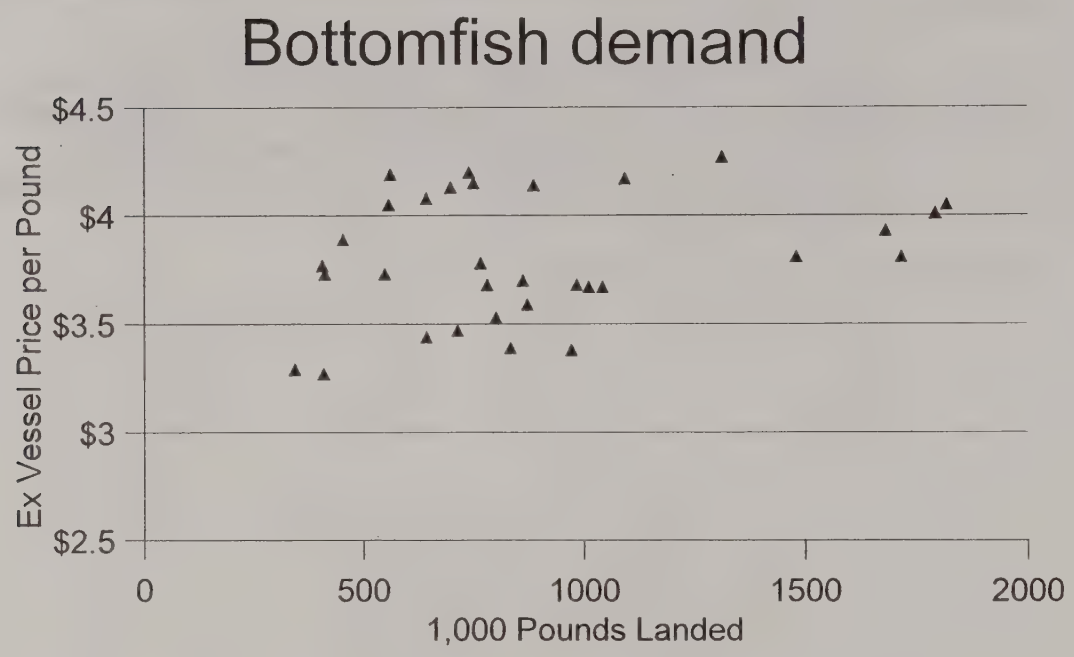
probably reflect the improved economic climate in Hawaii, increasing the demand for fresh seafood.

*Note: Interpretation of this figure has not been updated for 2001 data. The interpretation will be updated in the 2002 annual report.

Data & Data Sources: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings beginning in 1997.

Data imported from: B8700xN.xls (4/12/01)

Figure 12. Hawaii bottomfish demand (annual, inflation-adjusted ex-vessel price* and total domestic landings, 1970 - present.)

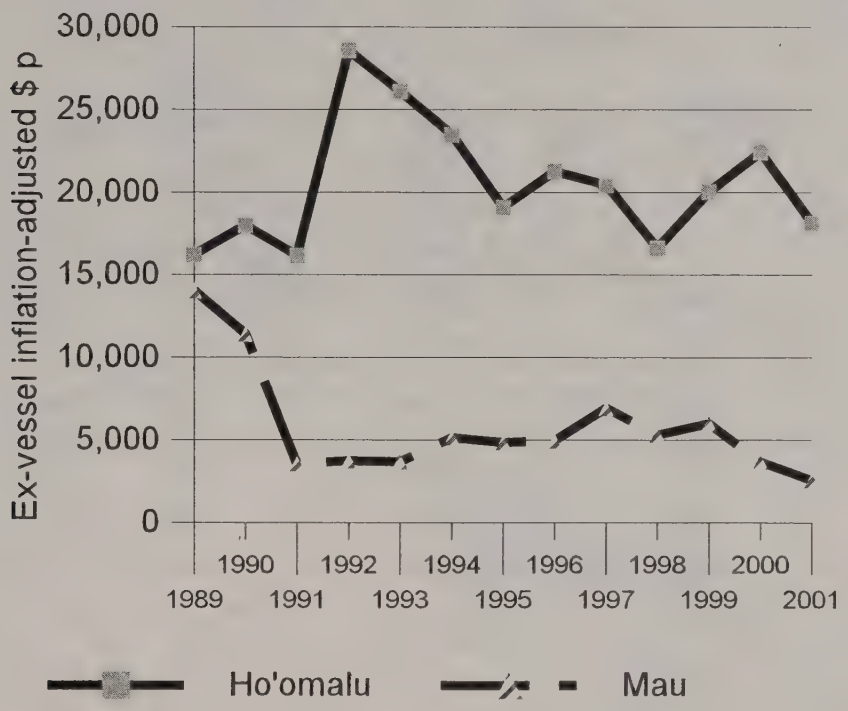


Interpretation*: Economic research in the mid-1980s showed a considerable (negative) relationship between weekly bottomfish landings and ex-vessel price. However this relationship is not shown for the annual data. As shown by this and the earlier figure, despite a considerable decrease in total landings since 1987, inflation-adjusted ex-vessel price has been quite stable over the past 30 years. The impact of imports may be significant since it now supplies about 40% of the local market.

*Note: Interpretation of this figure has not been updated for 2001 data. The interpretation will be updated in the 2002 annual report.

Data: See Figure 9.

Figure 13. NWHI bottomfish inflation-adjusted revenue* per trip by zone, 1989 - present.



Interpretation*: The two trends in inflation-adjusted revenue per trip show the distinct difference between Ho'omalu and Mau zone operations. When the limited entry provisions began to take effect in the Ho'omalu zone in 1989-91, revenue rose dramatically but has subsequently declined to slightly more than its average for the period. Revenue (inflation-adjusted) in the Mau zone initially fell (as the limited entry vessels could no longer fish in the Mau zone, only smaller boats remained in the Mau zone). After that initial drop, however, revenue per trip in the Mau zone rose for several years, but has subsequently declined again. Increasingly participation in the Mau zone is on a part-time basis and by vessels that do not specialize in bottomfish fishing. Additional trip revenue, in some cases a substantial proportion, comes from non-bottomfish landings outside the bottomfish grounds of the NWHI.

*Note: Interpretation of this figure has not been updated for 2001 data. The interpretation will be updated in the 2002 annual report.

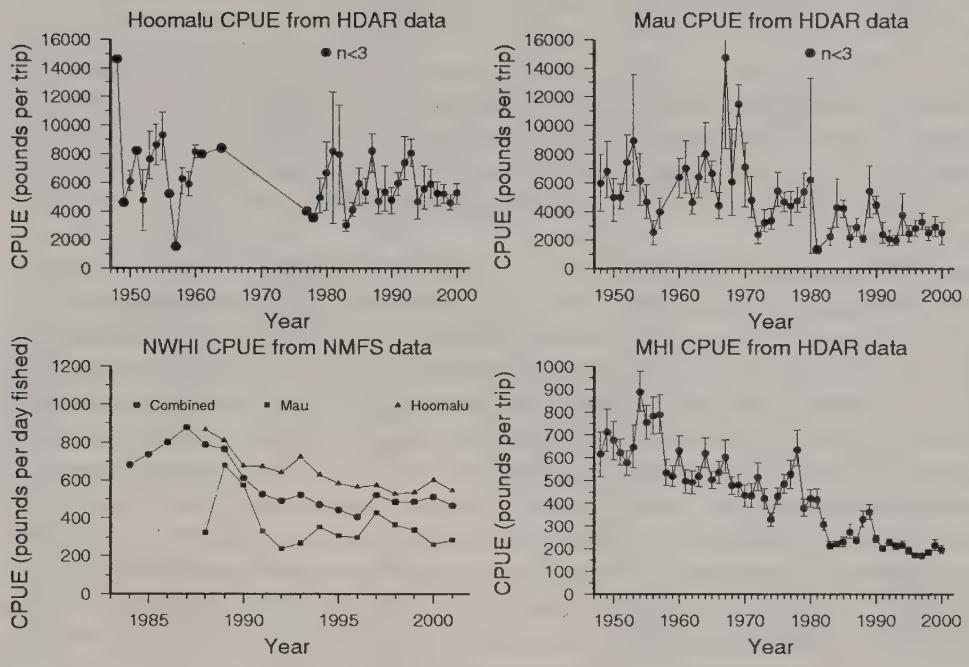
NWHI bottomfish inflation-adjusted fleet-wide revenue* and revenue* per trip by zone, 1989 - present.

Year	Ho'omalu Zone			Mau Zone		
	Fleet-wide Revenue* $1,000	Trips	Revenue* per Trip	Fleet-wide Revenue* $1,000	Trips	Revenue * per Trip
1989	454	28	16,214	309	22	14,045
1990	450	25	18,000	629	55	11,436
1991	761	47	16,191	300	84	3,571
1992	1,058	37	28,595	206	55	3,745
1993	888	34	26,118	266	72	3,694
1994	964	41	23,512	509	99	5,141
1995	630	33	19,091	471	97	4,856
1996	553	26	21,269	402	81	4,963
1997	777	38	20,447	368	53	6,943
1998	832	50	16,640	208	39	5,333
1999	962	48	20,042	180	30	6,000
2000	718	32	22,438	162	44	3,682
2001p	**744**	**41**	**18,146**	**141**	**55**	**2,564**
Average	753	37	20,516	319	60	5,844
Standard Deviation	192.3	8.3	3,833.1	149.6	24.5	3,315.4

Data: Data are compiled from NMFS shoreside market monitoring for 1984-95 and then combined with HDAR data for 1996 and 1997. Since 1998, data is compiled from HDAR figures. Revenue is adjusted for inflation to the current base year by the Honolulu consumer price index.

Data Source: Imported from B8700xN.xls (4/16/01)

Figure 14-a. CPUE for Hawaiian bottomfish



Interpretation: Decreases in MHI CPUE to about 30% of early CPUE values (mean of the first 5 years recorded) signify a strong yellow light condition for the fishery in this area. In the Mau zone CPUE has dropped from earliest values to 36% and 66% for trip based and daily based CPUE respectively, a borderline condition. For the Hoomalu zone these values are 65% and 74 % respectively, a healthy condition.

Comments: The MHI CPUE value for 2001 is very similar to the 2000 value, and remains above the 1996-1998 values. The 1999 increase in MHI CPUE was due primarily to a large increase in uku, and to a lesser degree onaga, catches and catch rates. This high in CPUE is similar to that of the late 1980s which was due to increased uku catch rates alone and may not indicate an increase in abundance of other species in either case. Rapid decreases in CPUE from the 1989-90 uku derived peaks appear to be a return to the prevailing slow decline.

In the Mau zone, trip CPUE dropped 19% from the 2000 value to about 36% of early values. On a catch per day basis, the Mau 2001 CPUE increased 9% to 66% of earliest values. Declines in trip CPUE for this zone may be largely due to the departure of highliners and greater concentration on other fishing methods, e.g. trolling and crab netting. Daily CPUE values are a

better indication of abundance and show an increase over last year.

In the Hoomalu Zone CPUE values dropped slightly from 2000 values on both a daily and trip basis.

The trip CPUE values are used for NWHI SPR calculations because they form a longer time series of data and may better estimate virgin fishery catch rates. There are no correction factors for possible changes in trip duration or fleet composition.

Source: MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen. Two NWHI CPUE's are presented. Trip based CPUE is derived from HDAR C-3 catch report data from the earlier years and more recently from HDAR trip sales reports. Daily CPUE is currently derived from HDAR daily catch logs. In earlier years, HDAR data was combined with the NMFS vessel interview program catch data to obtain appropriate data and full coverage.

Calculation & Adjustment: MHI trips were screened to only include trips from the areas of Maui, Lanai, Molokai, and Penguin Banks that had at least 90% of the catch by weight in bottomfish. Additionally, some MHI small boats were excluded based on minimum annual landings criteria to correct for temporal changes in the fleet composition (licensees must land at least 30% of the median value of the top ten producers to qualify). The NMFS vessel interview data prior to 1988 does not allow separate Mau and Hoomalu CPUE calculations; therefore, the combined area NWHI CPUE is presented as well. The NWHI trip CPUE used data screened to only include trips where at least 90% of the catch by weight was bottomfish and at least 1000 pounds of bottomfish were caught. All catch data reported by the same licensee on consecutive days were collapsed to a trip summary, since 1) most other reports are apparent multi-day trip summaries, and 2) consecutive day reporting may be reflective of marketing rather than fishing activity. There was an apparent absence of Hoomalu Zone trips from the mid-1960s until the late-1970s. The 95% non-parametric confidence intervals for the HDAR CPUE's were calculated by bootstrapping.

Figure 14-a data summaries:

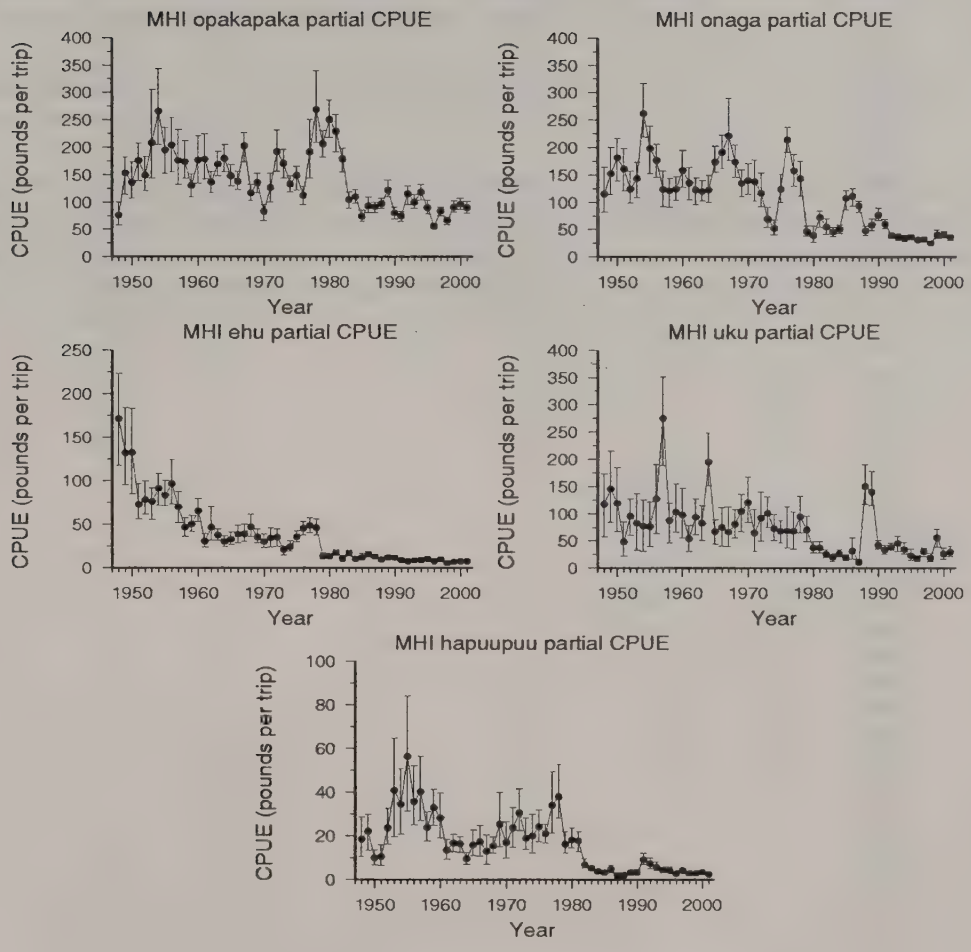
	Pounds/Trip		
Year	**MHI**	**Mau**	**Hoomalu**
1948	614	5968	14635
1949	713	6799	4614
1950	677	4966	6072
1951	621	4980	8228
1952	577	7407	4766
1953	645	8937	7627
1954	887	6158	8613
1955	755	4659	9336
1956	784	2523	5202
1957	789	3958	1535
1958	533	NA	6254
1959	519	NA	5897
1960	630	6379	8139
1961	496	6999	7978
1962	491	4641	NA
1963	518	6410	NA
1964	619	8028	8390
1965	503	6656	NA
1966	536	4413	NA
1967	602	14749	NA
1968	478	6055	NA
1969	480	11484	NA
1970	433	7111	NA
1971	433	4784	NA
1972	514	2386	NA
1973	421	3224	NA
1974	329	3367	NA

	Pounds/Trip		
Year	**MHI**	**Mau**	**Hoomalu**
1975	430	5439	NA
1976	485	4653	NA
1977	527	4387	4000
1978	635	4753	3550
1979	380	5361	4951
1980	421	6210	6687
1981	416	1336	8167
1982	307	NA	7953
1983	214	2242	3025
1984	220	4308	4085
1985	230	4239	5909
1986	274	2206	5301
1987	237	2889	8187
1988	329	2136	4702
1989	361	5412	5328
1990	245	4454	4793
1991	202	2413	5928
1992	228	2092	7388
1993	213	1992	8040
1994	218	3748	4651
1995	193	2460	5544
1996	125	2823	5870
1997	176	3294	5234
1998	130	2518	5198
1999	209	2926	4605
2000	187	2654	5212
2001	**184**	**2139**	**4945**
mean	433	4748	6163
s.d	194	2514	2218

NMFS NWHI CPUE (lb/day)

Year	Mau	Hoomalu	Combined
1984	NA	NA	682
1985	NA	NA	736
1986	NA	NA	800
1987	NA	NA	877
1988	322	866	786
1989	677	808	763
1990	573	675	611
1991	333	671	525
1992	239	639	491
1993	267	723	523
1994	353	629	526
1995	306	582	442
1996	298	563	407
1997	429	574	521
1998	364	527	484
1999	337	534	486
2000	260	601	513
2001	**283**	**543**	**467**
mean	360.07	638.21	594.72
s.d.	123.84	102.67	139.53

Figure 14-b. Partial CPUE for MHI bottomfish



MHI Partial CPUE (lb/trip)

Year	OPA	ONA	EHU	UKU	HAP
1948	77	115	172	117	18
1949	153	153	132	146	22
1950	135	182	132	119	10
1951	176	161	73	48	11
1952	149	124	78	95	24
1953	208	144	76	82	41
1954	266	262	91	77	35
1955	195	198	83	76	56
1956	204	177	97	127	36
1957	176	124	70	275	40
1958	174	121	47	88	24
1959	130	124	50	103	33
1960	177	158	66	97	28
1961	178	136	31	54	13
1962	136	123	47	94	17
1963	169	120	38	82	16
1964	180	122	30	195	9
1965	148	174	33	67	16
1966	138	191	38	75	17
1967	203	222	39	66	13
1968	116	174	47	81	15
1969	135	135	35	104	25
1970	83	140	30	120	17
1971	127	138	34	65	24
1972	192	116	35	92	31
1973	171	70	21	101	19
1974	132	52	24	72	20
1975	149	124	36	68	24
1976	112	214	45	69	21
1977	191	158	49	67	34
1978	269	143	46	94	38
1979	207	47	13	70	16
1980	251	40	13	37	18
1981	229	72	18	37	18
1982	179	55	11	25	7
1983	104	46	17	20	5
1984	109	51	10	26	4
1985	74	107	12	18	3
1986	93	111	15	31	5
1987	91	93	13	10	2
1988	97	48	9	150	2
1989	122	59	12	140	3
1990	80	77	12	42	3
1991	75	60	9	34	9
1992	115	39	8	39	7
1993	100	37	9	46	6
1994	118	34	9	34	4
1995	96	40	11	26	5
1996	56	31	8	18	3
1997	84	32	10	30	4
1998	66	25	6	19	3
1999	91	41	7	55	3
2000	96	41	8	26	3
2001	**90**	**36**	**8**	**29**	**2**
mean	142.07	107.72	38.39	73.67	16.35
s.d	52.71	59.21	35.98	48.81	12.62

Interpretation: Reduction of species-specific CPUE for species presented here, with the exception of opakapaka, to less than half of their early values would suggest a yellow light situation for all of these species. Caution must be used in this interpretation because factors such as targeting of effort to specific species is not taken into account (see next section for targeted effort).

Comments: All CPUE time series remain highly variable. All 2001 partial CPUE values are well below their long-term averages. There are apparent declines in most species when comparing several years of recent values with values earlier in the time series. The decline is least apparent in opakapaka and most apparent in ehu.

Source: The partial CPUE for the MHI is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The same subset of HDAR data as used in Fig. 14-A is used here, but the weight of each species is tabulated separately rather than in aggregate. The same denominator value used in Fig. 14-A is used here (# trips fished), i.e. summing these five partial CPUE's (and remaining BMUS CPUE's) will approximate the Fig. 14-A estimates. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 14-c. Partial targeted CPUE for MHI bottomfish

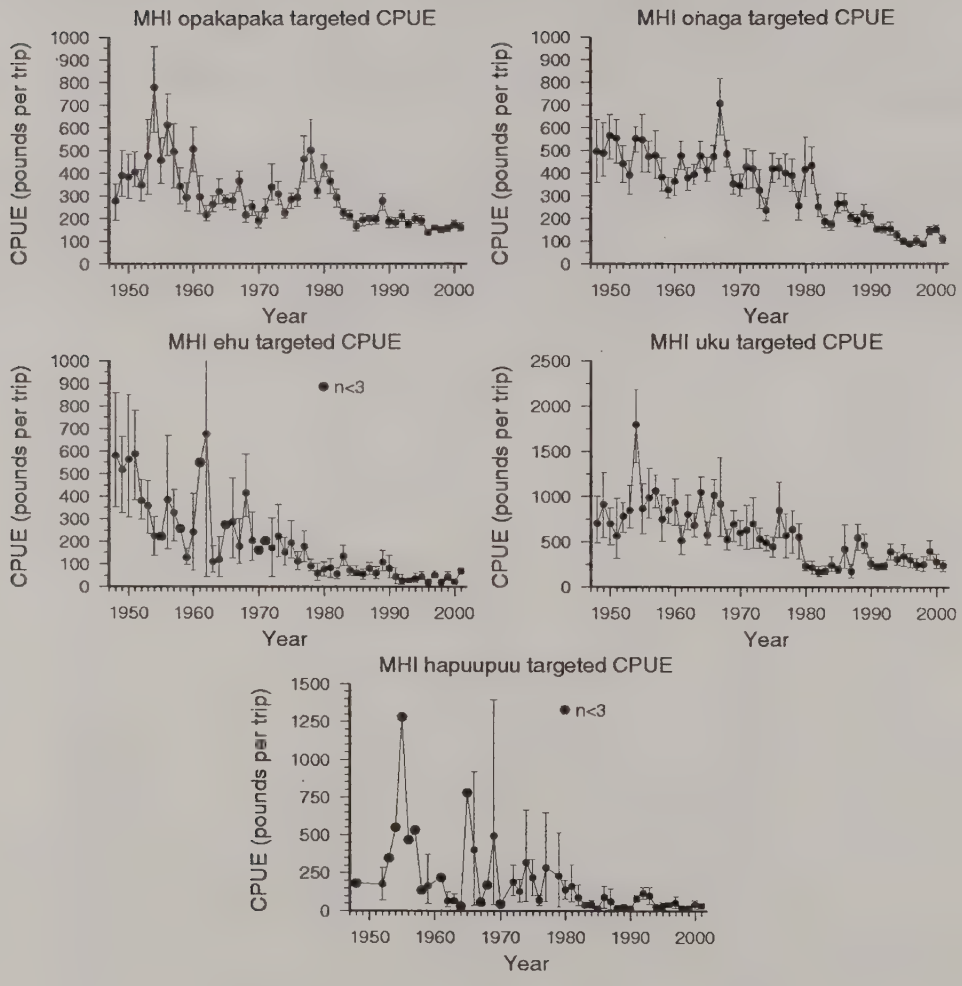


Figure 14-c data summary:

MHI Targeted CPUE (lb/Trip)

Year	Opakapaka	Onaga	Ehu	Uku
1948	277	496	581	705
1949	391	488	517	913
1950	385	566	564	701
1951	406	554	589	567
1952	348	442	380	779
1953	476	390	358	850
1954	779	552	224	1796
1955	458	547	222	869
1956	613	473	384	988
1957	496	479	327	1061
1958	344	382	257	745
1959	293	325	130	852
1960	507	364	242	939
1961	297	476	550	514
1962	216	379	677	806
1963	263	394	111	683
1964	320	475	120	1046
1965	281	411	275	574
1966	280	472	288	1014
1967	366	706	180	919
1968	215	484	415	525
1969	254	353	203	696
1970	191	345	161	600
1971	241	428	205	634
1972	339	420	171	699
1973	309	324	226	531
1974	225	236	152	488
1975	284	419	194	448
1976	293	421	112	846
1977	462	400	178	573
1978	501	389	92	640
1979	323	255	61	552
1980	430	415	79	235
1981	364	433	83	212
1982	293	252	58	164
1983	225	186	135	179
1984	212	173	72	241
1985	168	266	63	193
1986	194	267	58	418
1987	199	206	82	175
1988	198	192	60	549
1989	278	221	109	468
1990	187	205	82	260
1991	183	153	45	224
1992	212	154	27	238
1993	176	155	28	393
1994	200	125	37	311
1995	191	100	45	343
1996	138	88	21	300
1997	161	101	52	250
1998	148	87	21	251
1999	158	145	44	398
2000	174	150	23	282
2001	**162**	**109**	**70**	**239**
mean	297.85	333.85	193.33	571.78
s.d.	129.49	152.19	172.16	315.16

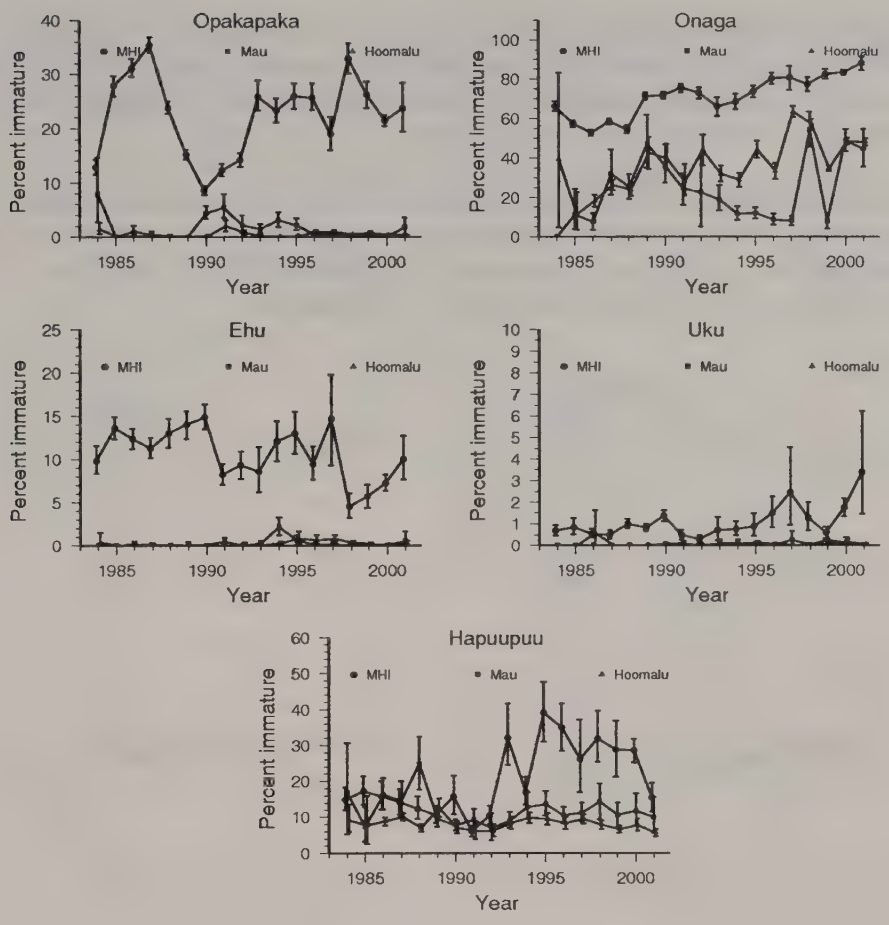
Interpretation: Comparison of 2001 CPUE values with the first 5 years available (1948-52) indicate that all four species for which sufficient data is available have CPUE values less than or equal to 50% of original values. These values represent a yellow light or borderline condition for these four species, with the ehu stocks being the most stressed.

Comments: As in Fig. 14-B, there are apparent declines when comparing recent years with values earlier in the time series. The decline is least apparent in opakapaka (45% of original values) and most apparent for ehu (13% of original values) even considering that 2001 was a relatively strong ehu year with targeted cpue higher than any year since 1990. The level of screening done here severely reduces the size of the sample, and this may contribute to some of the observed variability, particularly for ehu where there are fewer targeted trips. Values for hapuupuu are graphed but not put in the table due to the small numbers of targeted trips in most years.

Source: The partial targeted MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen.

Calculation & Adjustment: The data used in Fig. 14-A were further screened to only include trips where at least 50% of the total catch by weight is the target species. This can only be done for species that are targeted successfully; incidental catch species will not contribute significantly enough to the overall catch. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 15. Percent immature in Hawaiian bottomfish catch



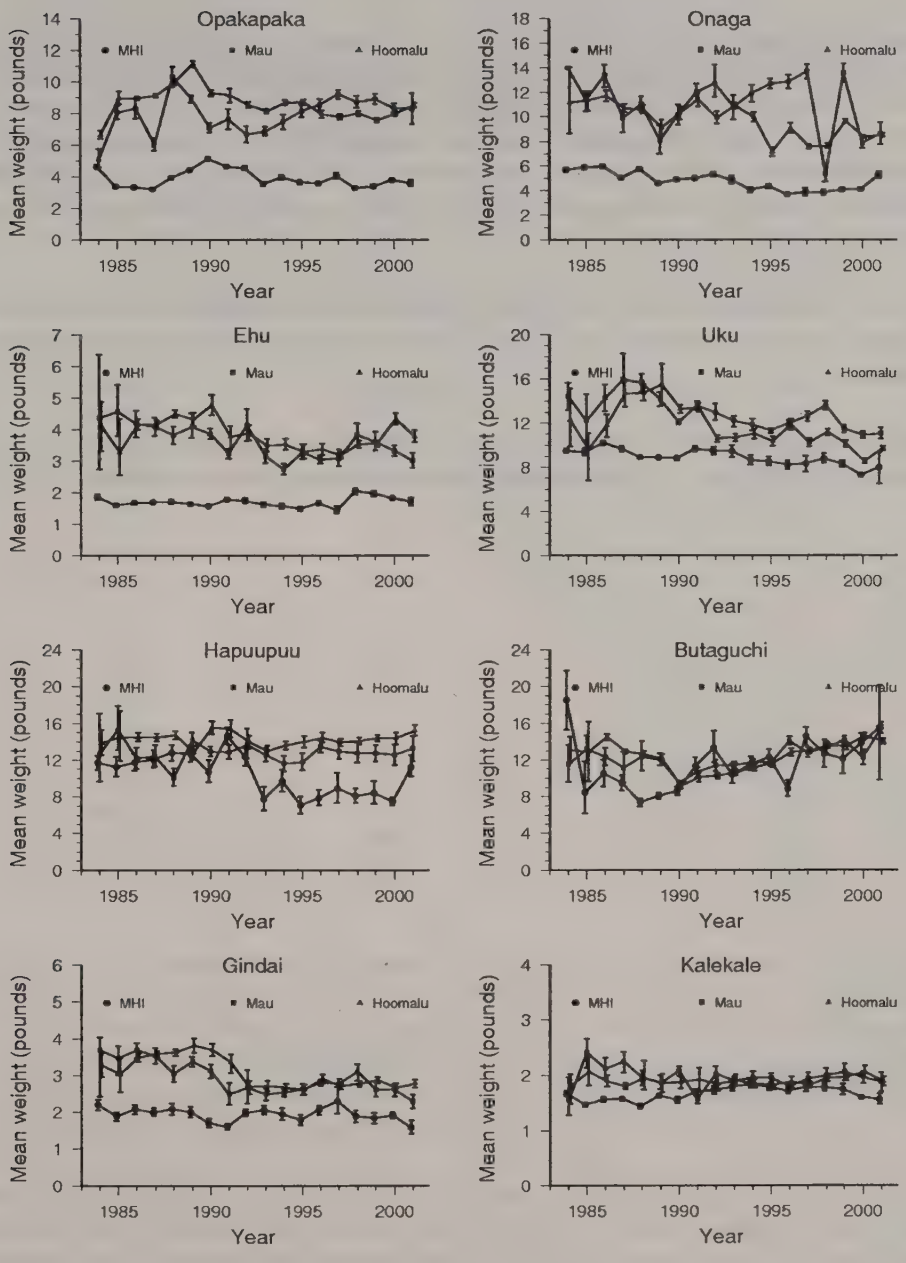
Interpretation: MHI onaga catch has the highest percentage of immature fish, and is the only one consistently over 50%. In 2001 the MHI onaga landings comprised of 88% immature fish, signifying a yellow light condition for this species in this zone. In the NWHI zones onaga showed high % immature values for 1997 and 1998 in the Hoomalu zone and 1998 in the Mau zone. 2001 values, however, are just below 50% for both zones, a borderline condition. All other MHI and NWHI values are in the healthy range for percentage of immature fish in the catch.

Comments: MHI catch is comprised of more immature fish than NWHI catch for all species. In all areas onaga values are the highest on average. Percent immature for uku are the lowest (i.e. healthiest) values in all zones. Among the other species, MHI opakapaka experienced periods of relatively high values (peaking in the years 1985-87) and a sharp rise in 1998. MHI hapuupuu percent immature declined from a peak in 1995 to moderate levels in 1997-2001.

Source: Prior to 2000 fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel. Data for 2000 is from dealer sales records. Size at maturity from Everson (1984), Everson (1990 unpub. rep.), Everson et al. (1989), Kikkawa (1984), Sudekum et al. (1991).

Calculation & Adjustment: The percent immature is calculated in terms of weight. The size distribution of sold fish is assumed to be representative of all fish caught. Maturity was assumed to be "knife-edge", and all fish in the same sales lot were assumed to be of equal size. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 16. Mean weight of Hawaiian bottomfish



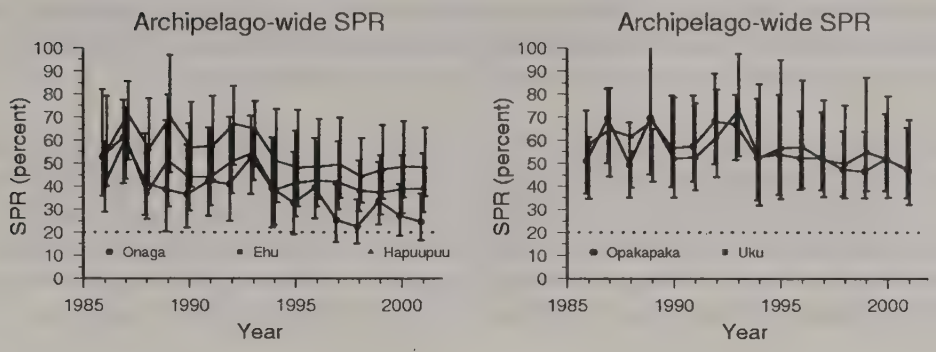
Interpretation: MHI mean weights are considerable lower than NWHI weights indicating considerable stress on these resources. No noticable trends can be seen in NWHI mean weights, indicating relative health in these zones. Low mean weights were first recorded for MHI hapuupuu in 1993 and remained low through 2000, but show a sharp increase in 2001. The small number of fish upon which the annual estimates are based may bias the results for this species.

Comments: Mean weights of fish in the NWHI catch appear generally stable over time, with the notable exception of the onaga mean weight, where recent declines can be seen for both the Mau and the Hoomalu zone. The 1998 Mau onaga value is the lowest on record showing a sharp decline from earlier values with a return to normal levels in 1999 then another drop in 2000 and a small increase in 2001. MHI values have been remarkably stable for most species over the time series available. The two most important changes in 2001 are the sharp increases in mean size of the Mau zone onaga and hapuupuu.

Source: Prior year's fish size data was derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS, and WPRFMC personnel; 2000 data is from HDAR dealer reports.

Calculation & Adjustment: The size distribution of sold fish is assumed to be representative of all fish caught. All fish in the same sales lot were assumed to be of equal size.

Figure 17. Archipelago-wide Spawning potential ratio (SPR)



Archipelago-wide SPR:

	SPR (%)				
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	41	55	53	51	58
1987	61	71	61	69	65
1988	37	56	42	49	62
1989	51	70	38	69	68
1990	44	57	36	57	52
1991	44	58	42	57	53
1992	51	67	41	68	61
1993	54	65	53	67	73
1994	38	51	39	53	52
1995	41	48	33	54	56
1996	43	49	39	52	57
1997	42	49	25	52	51
1998	38	44	22	47	50
1999	37	47	34	46	55
2000	39	49	27	52	52
2001	**39**	**48**	**25**	**48**	**46**
mean	43.75	55.25	38.13	55.69	56.94
s.d.	6.97	8.74	10.90	8.10	7.23

Interpretation: SPR values for the five major BMUS species are all above the 20% critical threshold level when viewed on an archipelago-wide basis. Of these species, onaga usually has the lowest value with the 2001 value at 25%. This low value for onaga is due to the consistently poor condition of the resources in the MHI. Now that the state management plan for the MHI bottomfish has been implemented, it is likely that the condition of onaga resources in this area will improve and the archipelago-wide SPR value will increase over time.

The archipelago-wide SPR estimates are the best method available to assess the Hawaii bottomfish resources and should be the only values used to evaluate overfishing. SPR values are also presented in this document on a management zone basis for the purpose of determining locally depleted resources. It is the best policy to have all zones in a healthy condition and

actions should continue to be implemented to assure the achievement of this goal. For the purpose of determining an overfished resource, however, the archipelago-wide condition is what should be measured. Evidence from larval drift simulation and preliminary genetic work point to as single archipelago-wide stock with substantial larval transfer between zones (generally from the more healthy northwestern zones toward the more depleted MHI zone).

Comments: SPR values for all species fluctuate annually and have wide error bars. There are no particularly obvious trends in SPR values over the 15 year period of data. The only species showing current signs of concern is the onaga for which the lower bound is below the 20% critical threshold value. The management measures implemented by the state for the MHI should bring improvement of the MHI onaga resource over a period of a few years. Any improvements to the MHI resources will contribute to improvement of the archipelago-wide condition as well.

Source: Data used in calculating archipelago-wide SPR is derived largely from HDAR commercial catch records integrated with NMFS interview data in some cases. Also important is the size frequency data obtained from market sampling by HDAR and NMFS and dealer reports. The final component is the weighting factor for each management zone, which is based on the percentage of total 100 fathom contour contained in each zone.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Preweighted SPR values (point estimates and upper and lower bounds) are from the area specific estimates found in the following section (Figure 18, 18a, b, and c). NWHI estimates are calculated using area specific maturity estimates and partial CPUE values (where area specific landings of each species are divided by the total effort expended in the management zone). For the MHI, hapuupuu SPR estimates are calculated similarly to those for NWHI fish. For the remaining MHI species, however, targeted trips are identified and the landings and effort for these targeted trips only are used to calculate CPUE for these species. Weighting factors are applied to point estimate and upper and lower bounds for each species and management zone. Archipelago-wide values are derived by adding the zone specific components. The weighting factors are: MHI = 0.447, Mau zone = 0.124, Hoomalu zone = 0.429.

Figure 18. Spawning potential ratio (SPR) for MHI bottomfish

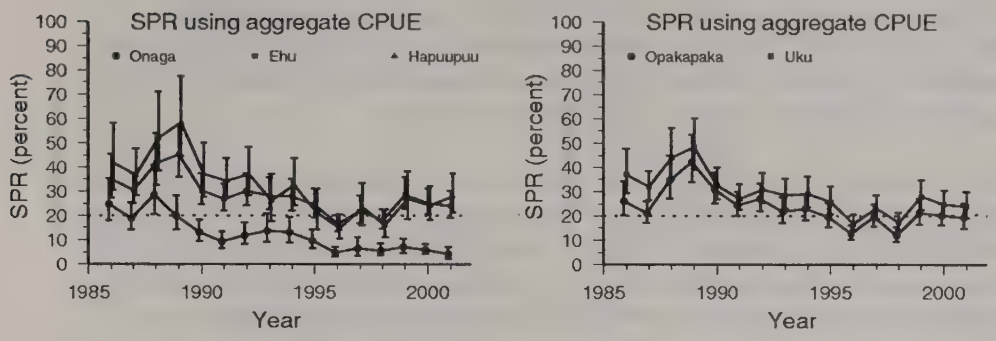


Figure 18 data summary:

			SPR (%)		
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	35	42	25	26	37
1987	31	37	19	21	32
1988	42	52	29	35	44
1989	45	58	20	42	48
1990	30	37	13	31	33
1991	27	34	9	24	27
1992	30	37	12	27	31
1993	28	26	14	22	29
1994	28	33	13	23	29
1995	24	21	10	20	26
1996	16	15	6	13	23
1997	22	23	6	20	23
1998	18	16	6	12	17
1999	29	27	7	21	28
2000	25	24	6	20	25
2001	**24**	**28**	**4**	**19**	**24**
mean	28.38	31.88	12.44	23.50	29.75
s.d.	7.62	11.95	7.39	7.59	7.92

Interpretation: The peak SPR values observed in 1988-1989 for all species were largely a response to increases in aggregate CPUE due to increased uku landings and catch rates. 2001 SPR values show improvements over low values for the major BMUS species in 1997 with the exception of onaga which shows an all time low for 2001. The improvement is largely due to an increase in aggregate CPUE over the low 1997 value. The 2001 value presented here for MHI hapuupuu is the best estimate of MHI SPR available, because we cannot calculate an SPR for this species using targeted CPUE. For the remaining species, the next section (Figure 19-A) gives the best estimation of 2001 MHI SPR.

Comments: Current SPR estimates for onaga in the MHI is below the twenty percent critical threshold level indicating localized resource depletion. Onaga remains below 20% for the 12

years in a row. Opakapaka spr at 19% is also below the 20% threshold.

Source: SPR is estimated from the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen. Additional information for opakapaka obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-1952 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish from the areas of Maui, Lanai, Molokai, and Penguin Banks (see Fig. 14-A for more details). Virgin catch size composition is estimated from the 1986-1988 NWHI catch data, and current catch size composition is estimated from single year MHI catch data. All SPR values may have changed slightly from previous year's reports due to more complete reporting and improvements in the calculations. The 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

Figure 19-a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE

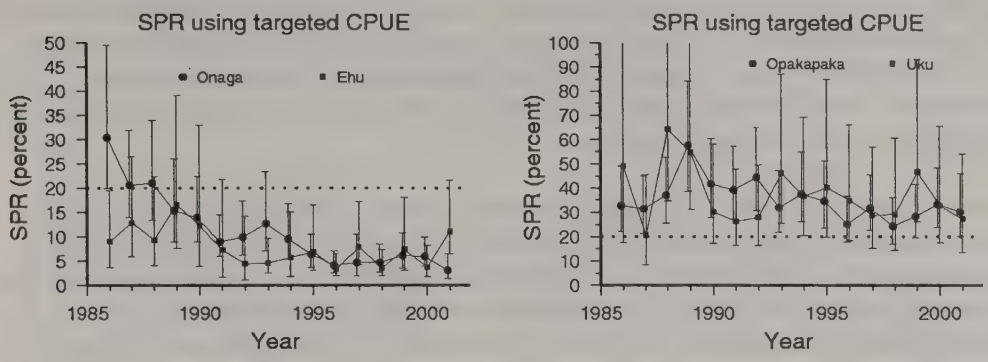


Figure 19a data summary:

	SPR (%)			
Year	**Opakapaka**	**Onaga**	**Ehu**	**Uku**
1986	32.71	30.37	8.99	49.11
1987	31.43	20.60	12.91	20.57
1988	36.88	21.03	9.30	64.24
1989	57.60	15.31	16.54	54.86
1990	41.73	13.86	12.32	30.29
1991	39.18	8.99	7.23	26.37
1992	44.41	9.95	4.37	28.01
1993	31.93	12.65	4.56	46.13
1994	37.48	9.49	5.76	36.51
1995	34.59	6.34	6.85	40.17
1996	25.10	4.12	3.36	34.96
1997	31.85	4.63	7.85	28.81
1998	24.30	4.68	3.53	29.28
1999	28.40	6.12	7.36	46.74
2000	33.33	5.94	3.72	32.76
2001	**30.29**	**3.07**	**11.10**	**27.27**
mean	35.08	11.07	7.86	37.26
s.d.	8.12	7.60	3.83	11.96

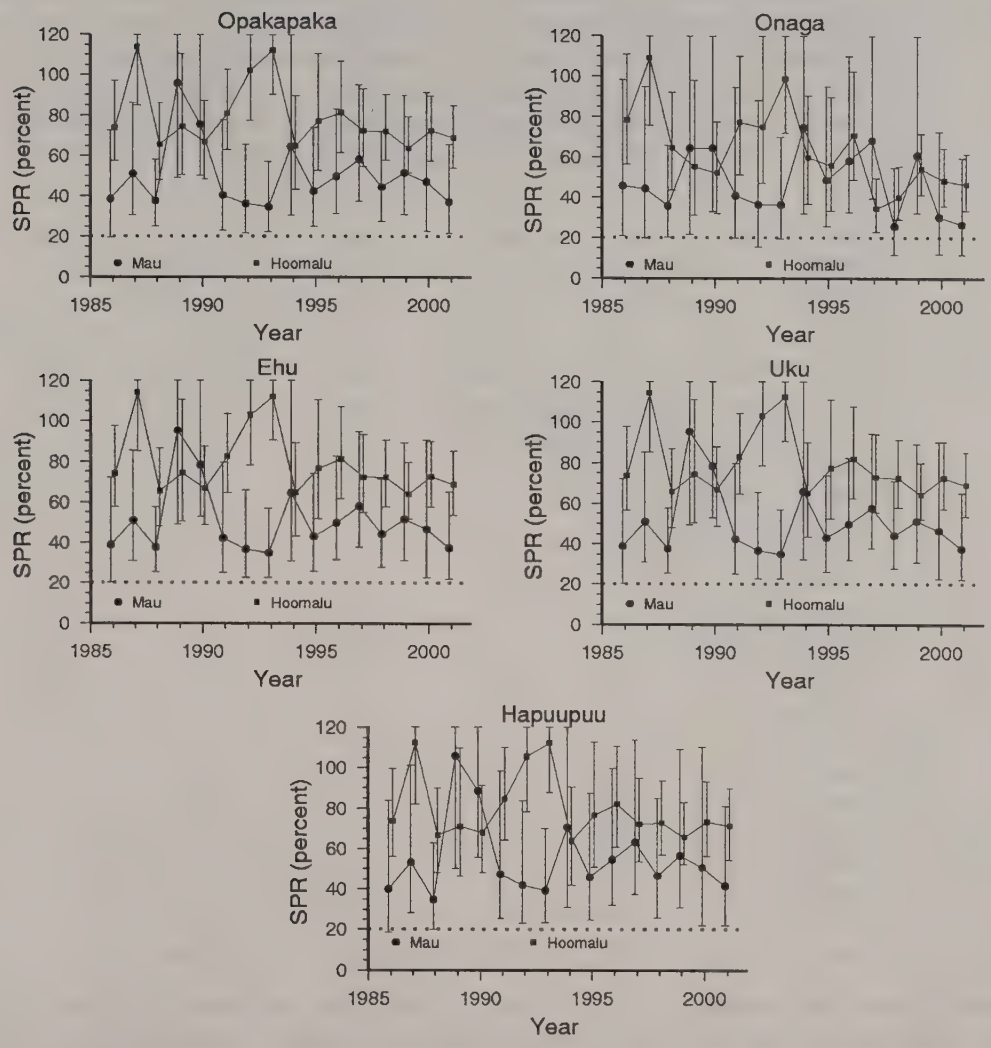
Interpretation: We feel that SPR values obtained here may better represent the condition of the MHI resources in regards to localized depletion than those found in the previous section. Ehu and onaga stocks are clearly stressed and well below the 20% SPR threshold, with ehu below the 20% level for the duration of our data and onaga on a continuing downward trend with values below 20% for the last13 years. Contrary to the results obtained in the previous section, opakapaka and uku SPR levels have remained above the 20% mark for all years sampled and do not indicate critical locally depleted conditions.

Comments: Targeted SPR values are available for only four of the BMUS species present in the MHI. As expected onaga and ehu values are below the 20% critical level and have been for many years. Opakapaka SPR values are higher using targeted CPUE compared to using aggregate CPUE. It should be noted that values reported here do not take into consideration any improvements to the stock resulting from State of Hawaii MPAs. If data were obtained on abundance and size of fish within the reserves, then estimates of CPUE, mean size, percent immature in the catch, and ultimately SPR could be made.

Source: SPR values are estimated using dealer reports; the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen and screened for trips targeting particular species. Additional information for opakapaka was obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations are conducted as in the previous section with targeted CPUE substituting for aggregate CPUE.

Figure 19-b. Spawning potential ratio (SPR) for NWHI bottomfish



Interpretation: The correlation of SPR values among species is due the high dependence of SPR on the CPUE component, given that the maturity component is nearly negligible for most species. All species utilize the same aggregate bottomfish CPUE component. The maturity component is small relative to MHI SPR calculations because 1) the NWHI catch is primarily mature fish, and 2) the current catch size composition is relatively unchanged from the best estimate of the virgin catch size composition.

Figure 19b data summary:

SPR (%)					
Mau Zone					
Year	**Ehu**	**Hapuupuu**	**Onaga**	**Opakapaka**	**Uku**
1986	39	40	46	39	39
1987	51	53	44	51	51
1988	38	35	36	38	38
1989	95	106	64	96	95
1990	78	89	64	75	78
1991	42	47	41	40	42
1992	37	42	36	36	37
1993	35	39	36	35	35
1994	65	71	75	64	66
1995	43	46	49	43	43
1996	50	55	58	50	50
1997	58	63	68	58	58
1998	44	47	26	44	44
1999	52	57	61	52	51
2000	47	51	30	47	47
2001	**38**	**42**	**27**	**37**	**38**
mean	50.75	55.19	47.56	50.31	50.75
s.d.	16.44	19.20	15.62	16.44	16.50
Hoomalu Zone					
1986	74	74	78	74	74
1987	114	112	109	114	114
1988	66	67	65	66	66
1989	74	71	55	74	74
1990	67	68	52	67	67
1991	83	85	77	81	83
1992	103	106	75	102	103
1993	112	112	99	112	112
1994	65	64	60	65	65
1995	77	77	56	77	77
1996	81	82	71	81	81
1997	72	72	35	72	73
1998	72	73	40	72	73
1999	64	66	54	64	64
2000	73	73	48	72	73
2001	**69**	**71**	**46**	**69**	**69**
mean	79.13	79.56	63.75	78.88	79.25
s.d.	16.19	16.09	20.31	16.10	16.13

Comments: Current SPR estimates for all five species in both zones are above the 20% critical threshold level indicating healthy resources on a local scale, though lower confidence limits often are near or slightly below this level. Mau Zone SPR estimates tend to be lower than Hoomalu Zone SPR estimates for most species and years, and onaga SPR estimates tend to be slightly lower than those for most other species in most years. Notable increases in 1999 onaga SPR values for the Mau and Hoomalu zones are due to decreases in the percent of immature onaga in the catches of these zones in that year.

Source: SPR estimated from Dealer reports or Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from data reported to HDAR by commercial fishermen.

Calculation & Adjustment: Calculations use same methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-52 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish calculated separately for Mau and Hoomalu Zones. Virgin catch size composition is estimated from the 1986-88 NWHI catch data, and current catch size composition is estimated from single year catch data. All SPR values changed slightly from previous year's reports due to improvements in the calculations. 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

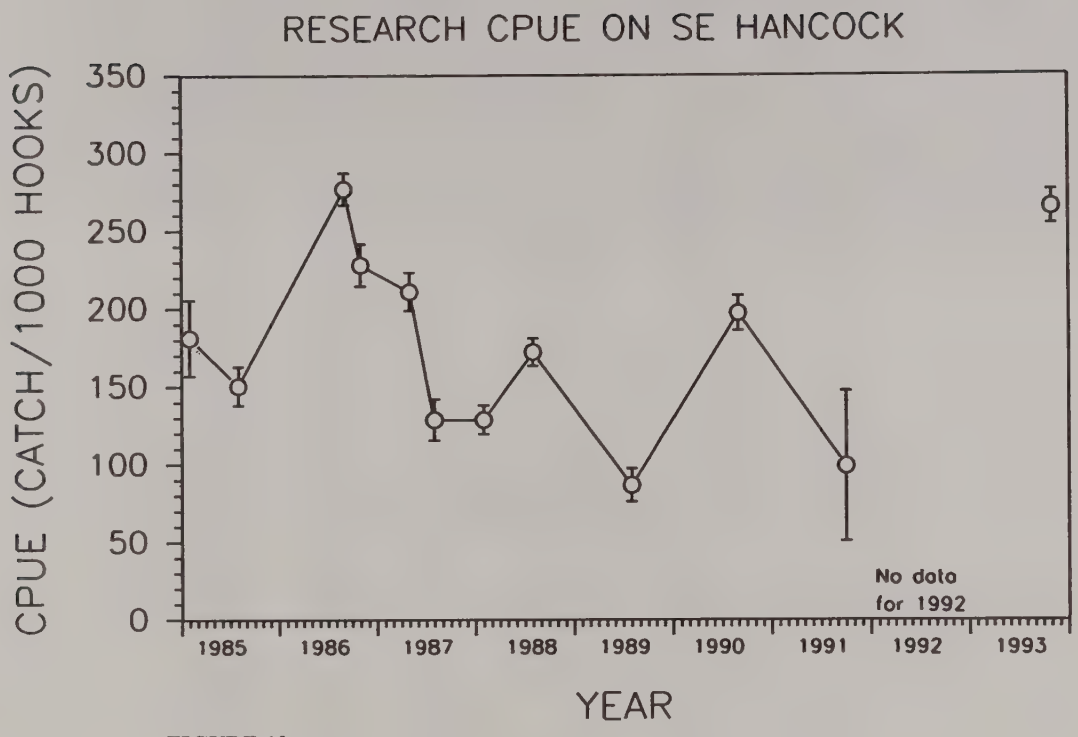


FIGURE 19

DATA SOURCE:

Figure 19 presents CPUE based on research longline catches at Southeast (SE) Hancock Seamount by NMFS, Honolulu personnel aboard NOAA ship R/V *Townsend Cromwell*. Vertical bars represent the 95% confidence intervals about the mean CPUE. The CPUE derived from the September 1991 stock assessment survey was computed using data from only the first 5 bottom longline sets as opposed to the standard 40 sets used on all other research surveys. The armorhead population at SE Hancock Seamount was not assessed in 1992 and post-1993 and therefore no current CPUE estimates are available. The last stock assessment survey for armorhead at SE Hancock Seamount was conducted in October 1993. Future NMFS armorhead stock assessment cruises to SE Hancock Seamount are unlikely. Henceforth, annual armorhead SPR values for Colahan Seamount (located outside the U.S. EEZ) will be provided to serve as a relative indicator of armorhead stock levels at the Hancock Seamounts (see explanation in Calculations & Adjustments subsection of ARMORHEAD SPAWNING POTENTIAL RATIO section).

CALCULATIONS & ADJUSTMENTS:

Fishing gear and sampling methods utilized during armorhead stock assessment surveys at SE Hancock Seamount are described in Somerton and Kikkawa (1992; Fishery Bulletin, U.S. 90:756-769). The seamount is divided into quadrants and effort is portioned equally among quadrants. Within each quadrant, effort is conducted over four depth strata (<265 meters (m), 265-300 m, 301-400 m, and 401-500 m). CPUE is calculated as a depth stratified average. Based on gear comparison studies of fishing droppers with and without hook timers conducted on the August 1990 survey, new coefficients accounting for the negative effects of hook timers were computed and applied to the catches obtained on all SE Hancock research surveys since 1985.

INTERPRETATION:

The fluctuations in CPUE shown in Figure 19 are apparently the result of episodic recruitment followed by high natural mortality. These peaks in CPUE correspond to years (1986 and 1990) where an appreciable proportion (at least one-third) of the armorhead population consisted of fat individuals (fatness index $\geq$0.26) considered new recruits to the seamount population. Fatness index is defined as body depth divided by fork length. Subsequent to recruitment individuals cease somatic growth and over the course of 3-4 years, survivors decline in fatness index and weight. Without subsequent recruitment to the population in suceeding years, the armorhead population as a whole would decline both in numbers (natural mortality) and in biomass (natural mortality and declining fatness index of survivors). The high 1993 CPUE is unusual, however, since fat individuals (new recruits) account for <15% of the 1993 population while leaner individuals (<0.23 in fatness index) form the bulk of the population. These results apparently indicate that the 1993 population is primarily derived from recruitment which occurred either in late 1991 or during 1992. Previous work indicates that little if any annual recruitment to SE Hancock Seamount occurs after the summer months (Humphreys et al. 1993; Fishery Bulletin, U.S. 91:455-463). Since the 1991 stock assessment survey coincided with the end of the summer season, the increase in CPUE at SE Hancock for 1993 is most likely due to good recruitment during 1992. The sharp increase in the 1992 CPUE among seamounts outside the U.S. EEZ implies that a high recruitment occurred (across all seamounts) in 1992.

TABULATED VALUES:

MONTH/YEAR	ARMORHEAD CPUE
JAN 1985	181.28
JUN 1985	150.51
AUG 1986	276.80
OCT 1986	228.03
APR 1987	210.98
AUG 1987	128.73
JAN 1988	128.77
JUL 1988	172.14
JUL 1989	86.69
AUG 1990	197.08
SEP 1991	98.97
1992	(unknown)
OCT 1993	264.85
1994	(unknown)
1995	(unknown)
1996	(unknown)
1997	(unknown)
1998	(unknown)
1999	(unknown)
2000	(unknown)
2001	(unknown)

ARMORHEAD SPAWNING POTENTIAL RATIO

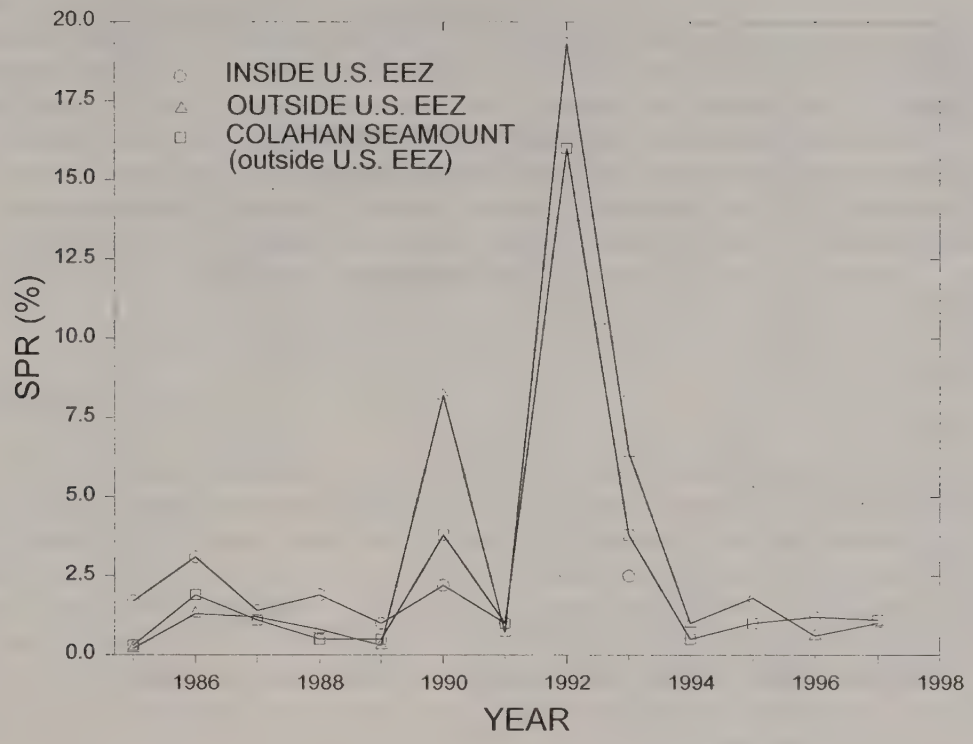


FIGURE 20

DATA SOURCE:

SPR values for seamounts outside the U.S. EEZ are based on reported catch and effort data from the Japanese trawler fleet and values for seamounts within the U.S. EEZ (Hancock Seamounts) are based on research longline CPUE in addition to the trawl CPUE. However, with the cessation of research longline cruises to the Hancock Seamounts, SPR values for Colahan Seamount (comparable in size and located closest to the Hancocks among seamounts outside the U.S. EEZ) are being provided now and in the future as an indicator of stock levels at the Hancock Seamounts. SPR values for Colahan Seamount are also based on reported catch and effort data at that seamount by the Japanese trawler fleet.

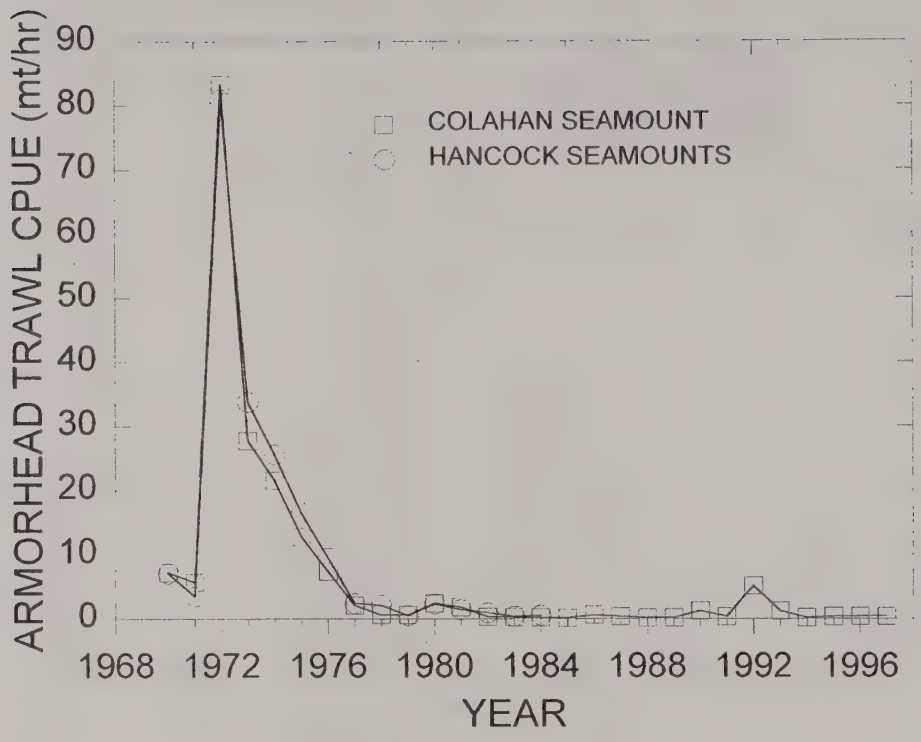


FIGURE 21

CALCULATIONS & ADJUSTMENTS:

SPR values outside the U.S. EEZ are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972). SPR values inside the U.S. EEZ are computed as the estimated biomass on SE Hancock Seamount divided by the 1970-1972 average biomass. Biomasses are estimated using procedures described in Somerton and Kikkawa (1992). The SPR values for Colahan Seamount are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972) at Colahan Seamount (Figure 20). Fishery catch and effort data by seamount by month for seamounts outside the the U.S. EEZ have been provided annually since 1980 by colleagues at the National Research Institute for Far Seas Fisheries in Shimizu, Japan.

The decision to use SPR values for Colahan Seamount (instead of the overall outside U.S. EEZ values) as an indicator of armorhead stock conditions inside the U.S. EEZ (i.e., Hancock Seamounts) is based on the greater similarities between these seamounts. Aside from Colahan Seamount, the seamounts fished for armorhead outside the U.S. EEZ are Milwaukee Seamounts

and Koko Seamount. These latter seamounts have summit areas of 67 and 564 nm^2 and average summit depths of 190 and 170 fm, respectively, while Colahan and the Hancock Seamounts have much smaller summit areas (about 1.4 nm^2) and shallower summit depths (141-150 fm). Fishing effort by the Japan trawl fleet has historically been
different at these two types of seamounts. Koko and Milwaukee Seamounts have always received the majority (about two-thirds) of the annual total trawling effort and were typically fished intensively over a sustained period of time. However, the fishing effort at Colahan and the Hancock Seamounts was applied in pulses since catch levels could not be sustained for more than several days without a "cooling off" period. These similarities plus the historical close coincidence between Colahan and Hancock Seamounts in temporal profiles of armorhead CPUE from the Japan trawl fleet (Figure 21) indicate that SPR values for Colahan Seamount should provide the best future indicator of armorhead stock levels at the Hancock Seamounts.

INTERPRETATION:

SPR within the region outside of the U.S. EEZ, which historically (Japan trawl fleet during the 1969-1981 period) contributed 91% of the total catch of armorhead, is 1.0%; based on the most current (1997) available catch and effort statistics from the Japan North Pacific trawl fishery. The 1996 SPR of 0.4% in last year's report was incorrect; the correct value (0.6%) however was only slightly higher. These low SPR values for the last two years of data indicate a continued depression in stock levels since the dramatic increase of SPR levels outside the U.S. EEZ in 1992 and the equally dramatic decline and continued low levels since then. This continuation of low stock levels outside the U.S. EEZ is interpreted to be a result of the intensive fishing effort on the high 1992 recruitment pulse coupled with little subsequent recruitment during 1993-1997 to compensate for losses due to fishing and natural mortality. Based on previous trends, catch levels are expected to remain low in 1998 unless offset by a large recruitment event.

Based on current estimates of a 2-2.5 year pelagic phase prior to seamount recruitment, the 1992 recruitment would have originated from the 1989-1990 winter spawning season. If this is correct, then the large 1992 recruitment originated from a parental stock which in 1989 had one of the lowest SPR values both inside and outside the U.S. EEZ (see table next page). This would appear to support the notion that dramatic increases in armorhead abundance across the seamounts are episodic and the product of environmental factors rather than simply a stock-recruitment relationship.

During February-March 1997, an oceanographic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V *Kaiyo Maru* by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Initial plans were to include research trawl hauls over Colahan Seamount, however, the ship was no longer equipped to conduct bottom trawl operations. Armorhead larvae were collected from surface waters around the Milwaukee Seamounts group, Colahan and C-H Seamount, but were absent from Koko Seamount. This same vessel conducted a research survey of pelagic stage armorhead in

open ocean waters of the North Pacific during November 1998. The major objective was to tag-and-release pelagic specimens from various locations distant from the seamounts in hopes of later obtaining seamount re-captures and movement data. Unfortunately, no pelagic stages of armorhead were encountered during this cruise.

MANAGEMENT ISSUES:

Effective September 1, 1998, the fishing moratorium on seamount groundfish at the Hancock Seamounts was extended for a third 6-year period until August 31, 2004. Based on current sustained low SPR values both at Colahan Seamount and at all SE-NHR seamounts outside the U.S. EEZ, it was inferred that the status of the Hancock Seamounts armorhead resource was similarly depressed. The intent of the moratorium is to provide continued long-term protection (which is absent elsewhere within the seamount habitat of the SE-NHR) to enhance the possibility of the armorhead resource to re-build via recruitment.

TABULATED VALUES:

	ARMORHEAD SPR (%)		
YEAR	INSIDE US EEZ	COLAHAN	OUTSIDE US EEZ
1985	1.7	0.3	0.2
1986	3.1	1.9	1.3
1987	1.4	1.1	1.2
1988	1.9	0.5	0.8
1989	1.0	0.5	0.3
1990	2.2	3.8	8.2
1991	1.0	1.0	0.7
1992	NA	16.0	19.3
1993	2.5	3.8	6.4
1994	NA	0.5	1.0
1995	NA	1.0	1.8
1996	NA	1.2	0.6
1997	NA	1.1	1.0
1998	NA	NA	NA
1999	NA	NA	NA
2000	NA	NA	NA
2001	**NA**	**NA**	**NA**

Appendix 4

Commonwealth of the Northern Mariana Islands

CONTENTS

Page

1. Summary 4-2

2. Historical Annual Statistics for CNMI Bottomfishes 4-3

3. List of Tables 4-4

4. List of Figures 4-4

5. Introduction 4-5

6. Recommendations 4-6

Summary

Landings of bottomfish seem to have significantly increased from last year (57.1% more pounds in 2001 than in 2000), to the highest level in 19 years. Bottom-fishing activity in the CNMI has been higher than the 19-yr mean for the last 6 years. The number of trips during which bottomfish were caught increased dramatically from 2000, yet the average bottomfish catch per trip continued to be below the 19-yr mean. This fishery continues to show a high turnover with changes in the high liners participating in the fishery, and an increased number of local fishermen focusing on reef fishes in preference to bottomfishes. Fishermen are moving towards an increasing number of multi-purpose trips that focus primarily on reef fishes and catch pelagic species while in transit. In doing so, the shallow-water bottomfish complex continues to be exploited, but as part of the exploitation of reefs near the populated islands. Redgill emperor (mafute') is the most frequently harvested and easily identified species in this complex. The CNMI Division of Fish and Wildlife has considerable data that is intended for use in a stock assessment, but an estimate of absolute age is nearly essential to complete the modeling of the populations. If a specialist capable and willing to read otolith daily-growth rings of redgill emperor (mafute') could be identified and contracted to age otoliths already collected, then it should be possible to complete a stock assessment for this species in the CNMI.

The number of large-vessel commercial bottom-fishing ventures active in the Northern Islands appeared to increase to eight during 2000, but only four were active for more than a few trips. Of these four, two primarily sold their catches off the island of Saipan (mostly to the large hotels in Tinian). Commercial trips made by these large vessels continue to be sampled on a monthly basis. These vessels catch the majority of the deep-water bottomfishes.

Domestic US, joint-venture, and foreign vessels continue to inquire about full-time bottom fishing throughout much of the CNMI. The impact of these ventures to the commercial market is still unclear despite a fish-market assessment study conducted in 1994, and completed in late 1996. The results of this study did not correspond with the significant increase in the Northern Islands bottomfish harvest.

Although revenues and prices for bottomfishes were greater in 2001 than in 2000, the average price per pound (adjusted) was still lower than the 19-yr mean. Only 8 years in the last 19 have lower values. Prices increased for all groups (from 5¢ to 56¢ per pound) from last year, with the exception of amberjack, which remained constant at $3.00/lb. Onaga still command the best prices, but the range is narrowing, with emperor (mafute') selling for the same price as ehu, gindai, and amberjack. Fishermen utilizing larger vessels have greater access to these deepwater resources, especially in the Northern Islands of the CNMI. Subsequently, the market demand should continue to increase as long as the supply of these fish increases with consistent quality. This industry could continue to expand with potential support by a training program in bottom fishing that addresses the following; proper fish handling, use of fathometers, nautical charts, modern electronic equipment such as GPS, fish finders, electric reels, anchoring techniques, and marketing. Moreover, side-band sonar mapping of the banks used by commercial fishermen from Farallon de Medinilla to Rota would greatly assist the growth of this sector.

Historical Annual Statistics for CNMI Bottomfishes

Year	Total Landings (lbs)	CPUE (lb/trip)	Inflation-adjusted Revenue ($)	Average Price (per lb)	Number of Boats
1983	22,683	43	76,806	3.39	90
1984	33,924	69	104,439	3.08	102
1985	32,780	116	94,173	2.87	55
1986	23,929	104	74,831	3.13	54
1987	39,772	168	114,270	2.87	42
1988	37,850	179	104,269	2.75	29
1989	19,550	76	58,758	3.01	29
1990	10,903	85	35,799	3.28	29
1991	5,693	46	20,309	3.57	20
1992	8,478	59	24,702	2.91	37
1993	14,769	83	41,414	2.80	20
1994	20,376	74	60,960	2.99	32
1995	28,881	93	102,229	3.54	34
1996	53,089	119	182,328	3.43	70
1997	51,271	136	173,465	3.38	69
1998	47,232	148	164,925	3.49	50
1999	44,961	157	164,126	3.65	51
2000	36,495	57	102,790	2.82	65
2001	**57,328**	**69**	**175,345**	**3.06**	**75**
Mean	31,051	99	98,734	3.16	50
Standard Deviation	15,633	42	52,919	0.29	23

TABLES

page

1. CNMI Consumer Price Indices 4-8

2. CNMI 2001 commercial landings of bottomfish species 4-9

3. Bycatch during CNMI bottomfishing 4-22

FIGURES

page

1. CNMI commercial bottomfish landings and revenue 4-10

2. Number of fishermen (boats) making bottomfish landings 4-12

3. Number of CNMI bottomfish trips 4-14

4. CNMI average price of bottomfish 4-16

5. CNMI average inflation-adjusted revenue per trip landing bottomfish 4-18

6. CNMI bottomfish catch in average pounds per trip 4-20

Introduction

The Commonwealth of the Northern Mariana Islands' (CNMI) bottomfish fishery occurs primarily around the islands and banks from Rota Island to Zealandia Bank north of Sarigan. However, this discussion will be limited to the catches landed on Saipan, which is by far the largest market. The fishery will be characterized by data collected through the Commercial Purchase Database, which indirectly records actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Division of Fish and Wildlife (DFW) staff routinely collected and distributed invoice books to almost 50 participating local fish purchasers in 2001; which include practically all fish markets, stores, restaurants, hotels, government agencies, and roadside vendors (fish-mobiles).

Although this data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fishery. Unfortunately, this database has 3 inherent problems, when used in this manner. First, a number of the bottomfish MUS are not listed on the sales receipts. This in turn results in a series of problems. This means that buyers must either write in a species name or decide within which general category that species falls. For example, *Lutjanus kasmira* may be written in as *saas* (the local name for the species), or the vendor must decide whether or not it should be included in "assorted bottomfish" or in "assorted reef fish." Given that this species is also a common reef inhabitant and may be caught while reef fishing, it is entirely possible that it will be included with the reef fishes and underrepresented in the bottom fishes. In addition, for those species that are correctly categorized as "assorted bottomfish," but not listed by the buyer to species, the species-specific totals may vary widely from year to year and under represent the sales of that species. *Etelis carbunculus* (*ehu*) is such a species. Unless the buyer specifically writes it on the invoice, sales of this species are likely to inflate the "assorted bottomfish" category. Moreover, for some species that are correctly listed by the buyer to species, they are input into the database under the "assorted bottomfish" category and therefore cannot be tracked specifically. *Pristipomoides auricilla* (yellowtail kalikali) is an example of this problem. Second, some bottomfish MUS are only listed as part of a general category. For example, *Caranx ignobilis* (giant trevally) and *C. lugubris* (black jack) are both lumped in the category "jacks," potentially with other carangids such as *Carangoides orthogrammus* (yellow-spotted trevally), *Caranx melampygus* (bluefin trevally) and *C. sexfasciatus* (bigeye trevally). Third, *Aprion virescens* (jobfish, highway, or uku) is listed on the sales invoice, but the data analysis software did not include this species in the bottomfish report. Modifications to the report module after the 2001 collection period have corrected this problem for the last 10 years.

The CNMI's bottom fishery still consists primarily of small-scale local boats engaged in commercial and subsistence fishing, but in recent years larger vessels (35–60 ft) have entered the fishery. The bottom-fishery is broken down into two categories; deep (>500 ft) and shallow (100–500 ft) water fishing. The deep-water fishery is primarily commercial, targeting snappers and groupers. The snappers targeted include the Eteline and *Pristipomoides* complexes, whereas

the eight-banded grouper (*Epinephelus octofasciatus*) is the only targeted grouper. The shallow-water fishery, which targets the redgill emperor (*Lethrinus rubrioperculatus*), is mostly commercial but also includes subsistence fishermen. These fishermen are taking not only bottomfishes, but many reef fishes as well. Hand lines, home-fabricated hand reels and electric reels are the common gear used for small-scale fishing operations, whereas electric reels and hydraulics are the common gear used for the larger operations in this fishery. Historically, some trips have lasted for more than a day, but currently, effort is defined and calculated on a daily trip basis. Fishing trips are generally restricted to daylight hours, with most vessels presumed to return before or soon after sunset, unless fishing in the Northern Islands. In terms of participation, the bottomfish fleet consists primarily of vessels less than 24 ft long that are usually limited to a 30-mi radius from Saipan. The larger commercial vessels that are able to fish extended trips and which focus their effort from Esmeralda Bank to Zealandia Bank have landed the majority of the deep-water bottomfish reported through the purchase receipt forms. In 2001, the most consistent high liner of previous years did not fish. Six other companies sold more than 500 pounds of onaga (*Etelis coruscans*), two of whom had previously contributed at this level in the last 5 years. Only five companies sold more than 500 pounds of emperor, and of these, one landed 37.0% of the total catch of emperor sold in 2001.

Bottom fishing requires more technical skill than pelagic trolling, including knowledge of the location of specific bathymetric features. Presently, bottom fishing can still be described as "hit or miss" for most of the smaller size (14–25 ft) vessels. Without fathometers or nautical charts, the majority of fishermen utilizing smaller vessels often rely on land features for guidance to a fishing area. This type of fishing is inefficient and usually results in a lower catch-per-unit-effort (CPUE) in comparison to pelagic trolling. These fishermen tend to make multi-purpose trips—trolling on their way to reefs where they fish for shallow-water bottomfish and reef fish. Larger sized (25-ft and larger) vessels typically utilize Global Positioning System (GPS), fathometers and electric reels, resulting in a far more efficient operation. In addition, reef fishes are beginning to command a consistently higher price than bottomfishes. This appears to be reflected in an increased number of fishermen using small vessels focusing on reef and/or pelagic species over bottomfishes.

Recommendations

1) To request NMFS and the Council to assist DFW in identifying an expert who is capable of and willing to prepare otoliths of redgill emperor and then count daily growth rings.

2) To request NMFS and the Council assist the CNMI by contracting a specialist to map commercial fishing banks, particularly around Farallon de Medinilla, Marpi Reef, and the banks closest to Saipan, Tinian, and Rota.

3) To request that Council merge the Bottomfish Plan Team (as well as the Crustacean Plan Team) with the Coral Reef Ecosystem Plan Team.

Table 1.—CNMI Consumer Price Indices (CPIs).

Year	CPI	CPI Adjustment Factor
1983	140.90	1.92
1984	153.20	1.77
1985	159.30	1.70
1986	163.50	1.66
1987	170.70	1.59
1988	179.60	1.51
1989	190.20	1.42
1990	199.33	1.36
1991	214.93	1.26
1992	232.90	1.16
1993	243.18	1.11
1994	250.00	1.08
1995	254.48	1.06
1996	261.98	1.03
1997	264.95	1.02
1998	264.18	1.03
1999	267.80	1.01
2000	273.23	0.99
2001	**270.98**	**1.00**

Calculation: The Commonwealth of the Northern Mariana Islands' Consumer Price Index is computed by the CNMI Department of Commerce using the Laspeyres' formula.

Table 2.—CNMI 2001 commercial landings of bottomfish species

Species	Landings (lb)	Revenue ($)	Average Price ($/lb)
Jacks	3,009	9,007	2.99
Amberjack	17	51	3.00
Grouper	6,175	15,943	2.58
Emperor (Mafute')	13,590	40,754	3.00
Lehi	2,068	6,889	3.33
Jobfish	340	995	2.92
Onaga	13,087	47,729	3.65
Ehu	6	18	3.00
Gindai	1,533	4,592	3.00
Opakapaka	3,161	10,907	3.45
Sickle Pomfret	323	575	1.78
Alfonsin	32	80	2.50
Assorted Bottomfish	13,988	37,806	2.70
Total	**57,328**	**175,345**	**3.06**

Interpretation: The weight of fishes categorized as "assorted bottomfish" increased from 12.6% of the catch in 1999 to 29.6% of the catch in 2000 and decreased to 24.4% of the catch in 2001. This may reflect an increased catch of BMUS species such as *Lutjanus kasmira, Pristipomoides sieboldii,* and/or *P. auricilla,* or a variety of other species also caught while bottom fishing such as *Lutjanus bohar, Variola albimarginata, Saloptia powelli, Etelis radiosus,* and others. Buyers are also reporting their sales in less detail. This remains a problem largely because the diversity of the catch is great and most buyers sell these species as "assorted bottomfish," so there is no perceived need to identify them more completely. Division of Fish and Wildlife staff members were however, successful in reducing the number of fishermen not identified on sales receipts (1.18% of the receipts in 1999, 0.81% of the receipts in 2000, and 0.86% of the receipts in 2001).

Eight of 13 categories of bottomfish showed increased landings in 2001. Jacks (carangids, including BMUS species *Caranx ignobilis* and *C. lugubris*) have generally increased over the last 7 yrs, with a mean landing of 1,833 lbs and an increase of 75.6% in 2001 over 2000. Amberjack have only been reported for the last 4 years, but the landings have been steadily decreasing, with a mean of 142 lbs and a decrease of 22.7% this year. This decrease is likely a combination of inherent problems with reporting and a change in the fishermen (and therefore the composition of the catch) of the larger vessels targeting the Northern Islands. The landings of groupers (*Epinephelus fasciatus, Variola louti,* and a wide variety of other species including *E. octofasciatus*) have varied widely over the last 7 years, with a mean landing of 5,388 lbs per year. The landings in 2001 were 122% higher than 2000. The landings of emperors (lethrinids, including mafute') seem to have peaked in 1997 and are now stabilizing. The mean weight of landings over the past 7 years was 10,534 lbs, with a 51% increase in the landings in 2001 over 2000. Lehi and jobfish landings have varied widely over the past 7 years, with means of 3,004 lbs and 340 lbs respectively. Lehi landings decreased by 1.1% from 2000, whereas jobfish landings increased 123.8% from 2000. Errors in the reporting of jobfish sales over the last decade were corrected in the database. Landings of onaga over the last 7 years have a mean of 12,530 lbs. The landings in 2001 were a 61.0% increase over last year. Landings of ehu (*Etelis*

carbunculus) have only been reported for the last 4 years, with a mean of 214 lbs. This year's landings were 83.3% less than the landings in 2000. This likely is a result of both decreased landings and the inherent problems with the reporting (given that buyers need to specifically add a line for this species) that are likely to inflate the assorted bottomfish category and result in greater year-to-year variation in reporting. Opakapaka (*Pristipomoides filamentosus,* and likely some *P. flavipinnis*) landings have varied considerably in the last 7 years, with a mean of 2,338 lbs. In 2001, opakapaka landings increased 141.9%. Gindai (*Pristipomoides zonatus,* and likely some *P. argyrogrammicus*) landings have also varied over the last 7 years, with a mean of 1,428 lbs. This year's landings are 793.6% greater than last year's. Kalikali (*Pristipoimoides auricilla* and *P. sieboldii*) and saas (*Lutjanus kasmira*) were not itemized this year. Landings of sickle pomfret (*Taratichthys steindachneri*) have been reported the last 3 years, with a mean of 289 lbs. The landings in 2001 were 9.5% less than those of 2000. Alfonsin (*Beryx decadactylus*) were reported this year for the first time.

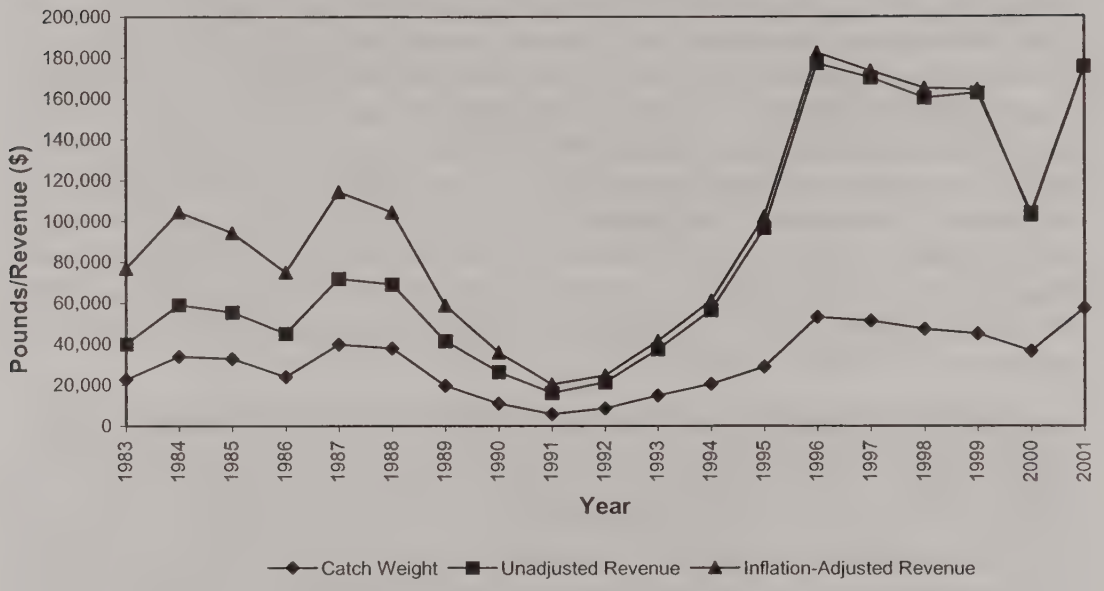
Forty-one percent of the fishermen reporting commercial sales of bottomfishes over the last 5 years have only done so in a single year. Only 8.2% of fishermen have bottomfish sales in all 5 years. Moreover, the high liners for each of the past 5 years have also shown this high rate of turnover. During the same period (1997 to 2001), the number of fishermen selling both pelagic fishes and bottom fishes decreased from 11.5 to 6.8%, the number selling both pelagic and reef fishes increased from 4.8 to 7.6%, and the number selling only reef fishes increased from 10.3 to 26.1%. This high rate of turnover, coupled with an increased focus on the commercial catch of reef fishes likely explains a large portion of this change.

Moreover, by examining the landings of emperors (lethrinids, including BMUS species *Lethrinus rubrioperculatus* and a variety of other species including *Gnathodentex aurolineatus, Lethrinus olivaceus, L. xanthochilus,* and others) the trends are even clearer. Sixty-five percent of the fishermen reporting sales over the past 5 years have only done so in a single year. Only 1 fisherman reported commercial sales of emperors in all 5 years and a single fisherman contributed 36.9% of the 2001 catch. Only 4 other vessels sold more than 500 pounds of emperor in 2001. The number of fishermen selling emperors increased slightly to 37 vessels this year (from 32 for the last 3 years). This species continued to be a seasonal favorite of smaller (25–30 foot) vessels harvesting around the islands of Farallon de Medinilla, Saipan, and Tinian.

Although revenues and prices for bottomfishes were greater in 2001 than in 2000, the average price per pound (adjusted) was still lower than the 19-yr mean. Only 8 years in the last 19 have lower values. Prices increased for all groups (from 5¢ to 56¢ per pound) from last year, with the exception of amberjack, which remained constant at $3.00/lb. Onaga still command the best prices, but the range is narrowing, with emperor (mafute') selling for the same price as ehu, gindai, and amberjack. Most fishes are sold as whole fish (and very few as filets or steaks). The larger species are often purchased by the hotel restaurants, which are now seeing far fewer customers. In addition, it is possible that the local public show greater demand for reef fishes. This may be reflected in the high price commanded by reef fishes such as parrotfishes and rabbitfishes.

Calculation: Annual summaries for each species from invoice data sheets.

Figure 1.—CNMI commercial bottomfish landings and revenue.



Interpretation: Landings, revenues, and adjusted revenues for 2001 were high, with only those of 1996 slightly higher. Most striking is the marked decrease in the landings, revenues, and adjusted revenues for 2000. This may be the result of changes in local staff. The position of supervisor for the section that collects these commercial purchase data was vacant for more than 6 months during 2000. Although the landings, revenues, and adjusted revenues for bottomfishes has been relatively comparatively high for the last 6 years compared to the preceding 13 years, there have been considerable changes in the composition of the fishery during this time.

The number of fishermen selling onaga (as representative of the deepwater bottomfish complex) has remained relatively constant for the previous 4 years (10, 14, 13, and 15, respectively). This year, 23 fishermen sold onaga. In each of the years 1997–2000, 2 or 3 fishermen have landed more than 1000 pounds (3 or 4 have landed more than 500 pounds). This year, 5 fishermen landed more than 1000 pounds (and 6 landed more than 500 pounds). No one fisherman was a high liner every year and only two sold more than 1000 pounds in 4 of the 5 years. In addition, 63% of the fishermen only sold onaga in 1 of the 4 years. Vessels capable of landing large amounts of onaga almost always are larger vessels fishing the Northern Islands. The difficulty of maintaining the equipment, vessel, and crew to consistently and routinely make these trips successful appears to be difficult over the long term for fishermen in the CNMI.

The number of fishermen selling mafute' (as representative of the shallow-water bottomfish complex) remained at 32 for the past 3 years, but increased to 37 in 2001. In each of these years, 1 to 4 fishermen have landed more than 1000 pounds (4 to 6 have landed more than 500 pounds),

but only one has been a high liner in all five years. Like the onaga fishermen, 65.0% of the fishermen only sold mafute' in 1 of the 5 years. In 2001, the number of pounds of mafute' landed would have been much smaller, if it were not for two fishermen who together landed 58.9% of the emperors. Many of the fishermen catching mafute' do so locally, but appear to be increasing their focus on reef fishes. The bottomfishes are a smaller portion of their sales and seem to be co-lateral catch (i.e., if caught in sufficient numbers while focusing on other species, then they too will be sold).

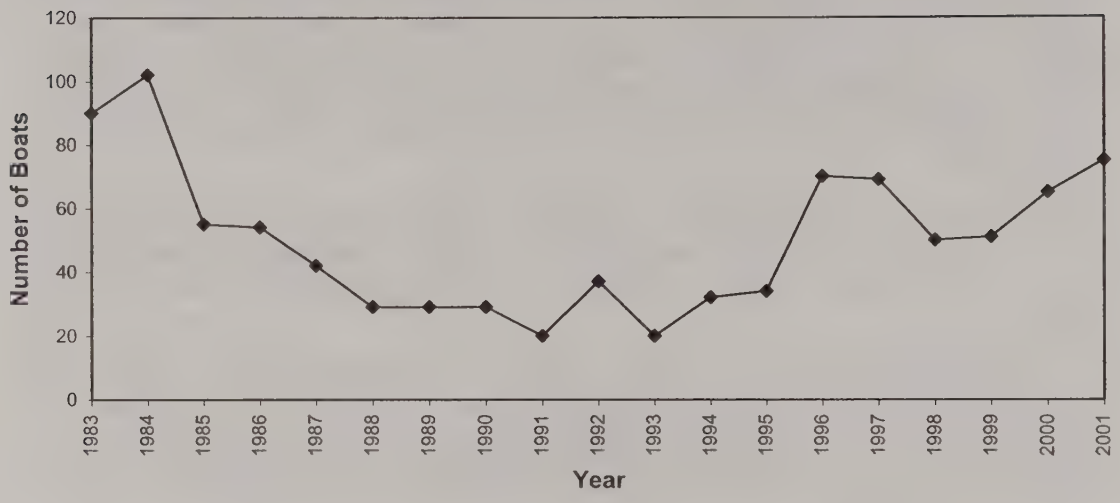
Revenues and inflation-adjusted revenues are high; higher revenues were only reported in 1996. Note that these higher prices were from a smaller total catch. Overall prices of bottomfishes have decreased over the past few years. Local buyers seem to increasingly prefer reef fishes.

Calculation: Landings in pounds are from a simple database summation of reported purchases of all bottomfish species combined. Revenue in dollars is from the same type of data base summation of the value field. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2001 CPI figure as the basis by which calculations of previous years' prices are made.

Summary Data:

Year	Pounds	Unadjusted Revenue	Inflation-adjusted Revenue
1983	22,683	40,003	76,806
1984	33,924	59,005	104,439
1985	32,780	55,396	94,173
1986	23,929	45,079	74,831
1987	39,772	71,868	114,270
1988	37,850	69,052	104,269
1989	19,550	41,379	58,758
1990	10,903	26,323	35,799
1991	5,693	16,118	20,309
1992	8,478	21,295	24,702
1993	14,769	37,310	41,414
1994	20,376	56,444	60,960
1995	28,881	96,442	102,229
1996	53,089	177,017	182,328
1997	51,271	170,064	173,465
1998	47,232	160,121	164,925
1999	44,961	162,501	164,126
2000	36,495	103,828	102,790
2001	**57,328**	**175,345**	**175,345**
Mean	31,051	83,399	98,734
Standard Deviation	15,633	57,149	52,919

Figure 2.—Number of fishermen (boats) making bottomfish landings.



Interpretation: The number of boats or fishermen making commercial landings of any bottomfish species declined from 1985 to 1988, stabilized between 1988–1990, slightly increased during 1992, decreased again in 1993, then increased during 1994 and 1995, and increased 100% in 1996. The number of vessels making bottomfish trips dropped in 1998 and 1999 to near the 16-year average. Over the past 2 years, there seems to have been a steady increase in the number of boats or fishermen making commercial sales.

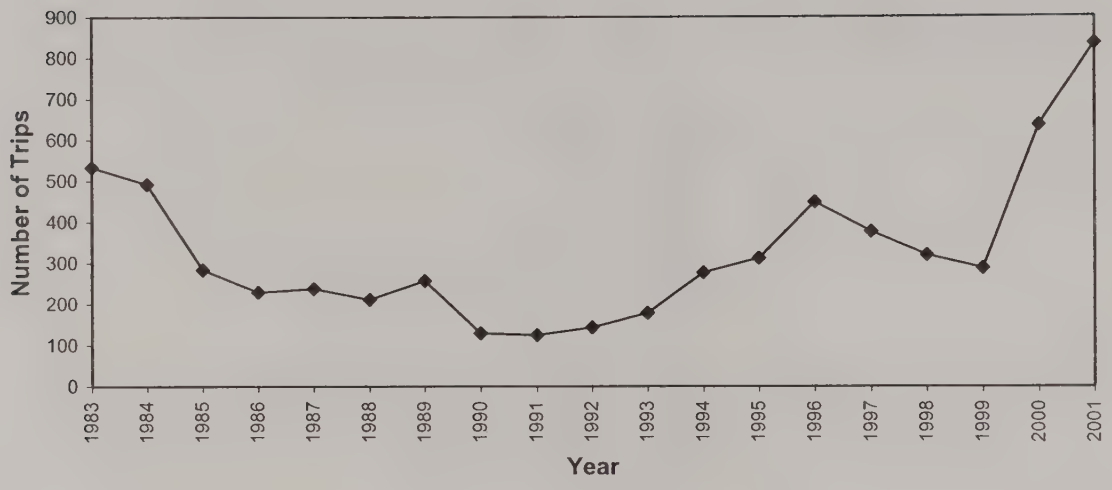
Note however, that almost 62.4% of the vessels selling bottomfishes between 1997 and 2000, only sold bottomfish in 1 of the 4 years. 19.4 to 34% of these fishermen also made a limited number of sales (2) of any type of fish in any given year. Only 6% sold bottomfishes all 4 years. This seems to be a high rate of turnover. More of the smaller vessels are focusing on reef fishes in preference to bottomfishes. Between 1997 and 2001, the number of fishermen selling pelagic fishes, bottomfishes and reef fishes increased from 12.1 to 16.2%, those selling both pelagic fishes and bottom fishes decreased from 11.5 to 6.8%, the number selling both pelagic and reef fishes increased from 4.8 to 7.6%, and the number selling only reef fishes increased from 10.3 to 26.1%.

Calculation: The fisherman or boats selling the catch is identified on the "trip ticket" invoices used by purchasers. This assumes that the fisherman selling the catch is the only fisherman involved; that is, that these fish were all caught and sold by one fisherman alone. The plot shows the number of unique fishermen making any landings of bottomfish within a given year.

Summary Data:

Year	Boats
1983	90
1984	102
1985	55
1986	54
1987	42
1988	29
1989	29
1990	29
1991	20
1992	37
1993	20
1994	32
1995	34
1996	70
1997	69
1998	50
1999	51
2000	65
2001	**75**
Mean	50
Standard Deviation	23

Figure 3.—Number of CNMI bottomfish trips.



Interpretation: The number of bottomfish trips more than doubled in 2000 (compared to 1999) to reach the highest level in the past 18 years, although the number of fishermen making landings increased only slightly (Figure 2). This same trend continued in 2001. The number of bottomfish trips was high from 1984 through 1988 as a result of consistent fishing activity in the Northern Islands, centered on the island of Farallon de Medinilla. This fishery subsequently ceased by 1990, resulting in the steep drop in bottomfish trips in the early 90s. In 1994, consistent fishing activity in the Northern Islands began once more and has continued to the present. From a high in 1996, the number of trips decreased for a few years (by 16.0% in 1997, by 15.2% in 1998, and by 10.7% in 1999).

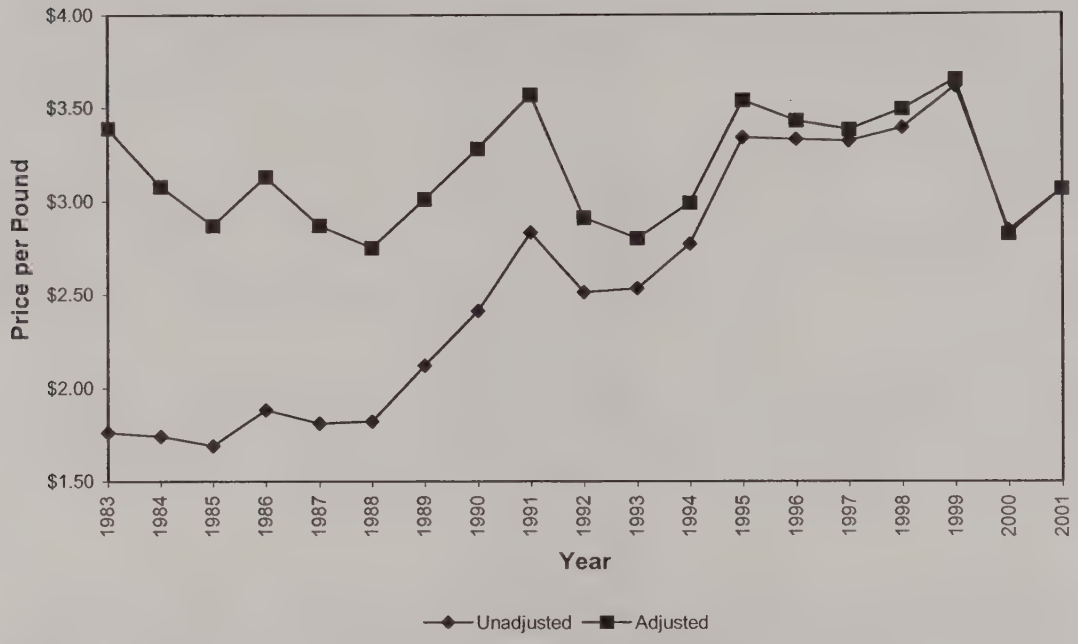
As more of the smaller vessels increase their focus on reef fishes, bottomfishes are still being caught and sold, but they are no longer the largest (or most valuable) part of the catch. This may result in fishermen catching bottomfishes as co-lateral catch on more trips, but adding up to smaller landings. Between 1997 and 2001, the number of fishermen selling pelagic fishes, bottomfishes and reef fishes increased from 12.1 to 16.2%, those selling both pelagic fishes and bottom fishes decreased from 11.5 to 6.8%, the number selling both pelagic and reef fishes increased from 4.8 to 7.6%, and the number selling only reef fishes increased from 10.3 to 26.1%.

Calculation: Adding each recorded fisherman's trip on a given day tallies the number of trips that resulted in landing any bottomfish. This assumes that each fisherman lands only once in a given day, and that all of the catch is sold on that day. Most trips last a single day, but it is also known that the occurrence of longer fishing trips is increasing.

Summary Data:

Year	Trips
1983	533
1984	492
1985	283
1986	229
1987	237
1988	211
1989	257
1990	129
1991	124
1992	143
1993	178
1994	276
1995	311
1996	448
1997	376
1998	319
1999	287
2000	635
2001	**834**
Mean	332
Standard Deviation	185

Figure 4.—CNMI average price of bottomfish.



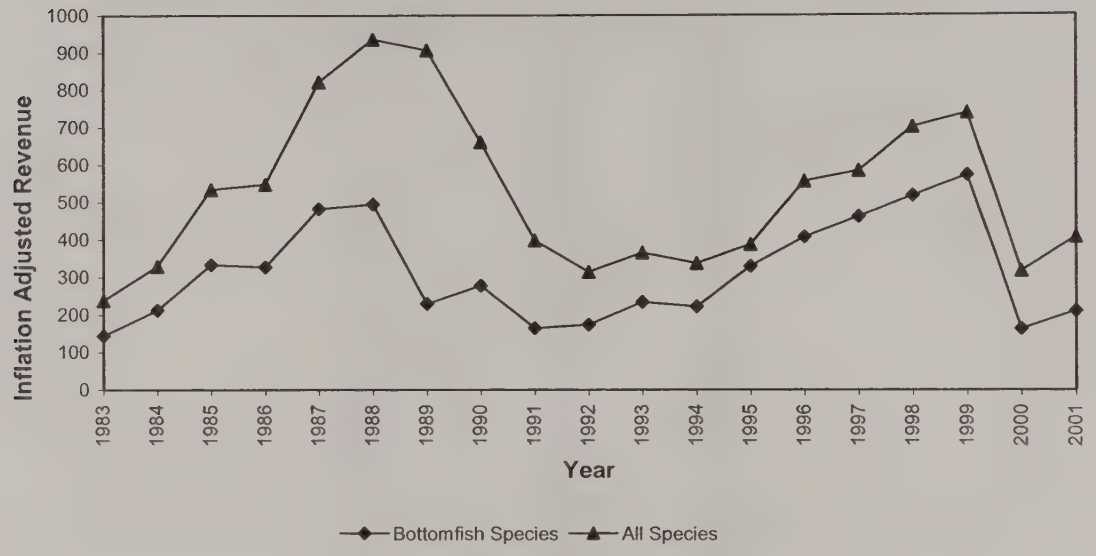
Interpretation: The average price increased steadily from 1988 to 1991, where it reached what was once a record high of $2.83. In 1995, the price increased to a new record high of $3.34. This unadjusted price remained constant through 1997, increased to $3.41 in 1998, and then reached a new record high of $3.63 in 1999. The adjusted price continued to increase from 1997. Both the unadjusted and adjusted prices fell steeply in 2000 and recovered slightly in 2001. Other than the drop in 2000, the unadjusted and adjusted prices were the lowest since 1994. The unadjusted price is slightly higher than the 19-yr mean. The adjusted price was 10¢ lower than the 19-yr mean, but 24¢ higher than last year. Only 8 years in the last 19 have lower adjusted price values.

Calculation: The average price of the bottomfish complex is calculated by dividing the total revenue by the total landings. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2001 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983–1987 were not available from the appropriate CNMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Summary Data:

Year	Unadjusted $/lb	Adjusted $/lb
1983	1.76	3.39
1984	1.74	3.08
1985	1.69	2.87
1986	1.88	3.13
1987	1.81	2.87
1988	1.82	2.75
1989	2.12	3.01
1990	2.41	3.28
1991	2.83	3.57
1992	2.51	2.91
1993	2.53	2.80
1994	2.77	2.99
1995	3.34	3.54
1996	3.33	3.43
1997	3.32	3.38
1998	3.39	3.49
1999	3.61	3.65
2000	2.84	2.82
2001	**3.06**	**3.06**
Mean	2.57	3.16
Standard deviation	0.66	0.29

Figure 5.—CNMI average inflation-adjusted revenue per trip landing bottomfish.



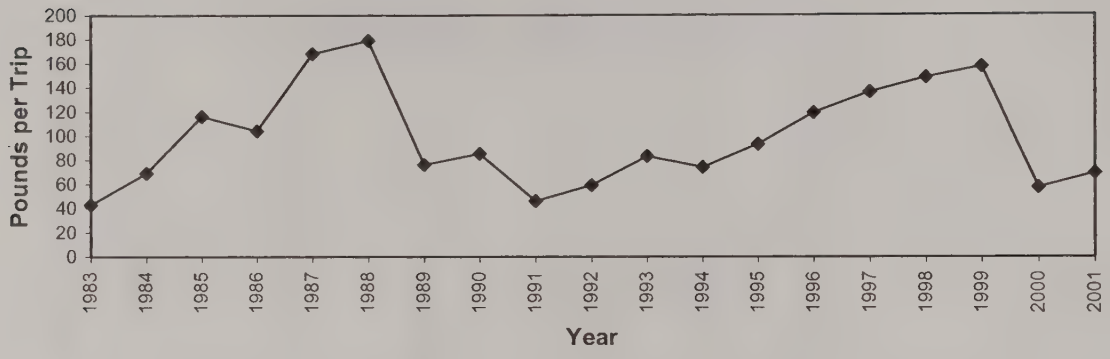
Interpretation: Inflation-adjusted bottomfish and the inflation-adjusted all-species revenues both recovered slightly from the marked decrease of 2000. The "bottomfish species" inflation-adjusted revenue recovered to 81.7% of the 19-yr mean adjusted revenue for bottomfishes. At the same time, the "all-species" inflation-adjusted revenue only recovered to 76.8% of the 19-yr mean. It is not clear whether the dip in "bottomfish species" and "all-species" inflation-adjusted revenues during 2000 was largely the result of staff turnover and the resultant loss of data, or indicative of a decrease. These data may suggest a decadal cycle in abundance (reflected in catch) with peaks in 1988–1989 and 1998–1999. The bottomfish fishery has always been a small proportion of the total fisheries, and it appears that bottomfish are now a relatively lower percentage of the trip revenue on trips where bottomfish were caught.

Calculation: Only trips that landed bottomfish are included in these calculations. "Bottomfish $/Trip" is the total revenue of the bottomfish sold from a trip, and "All Species $/Trip" is the total trip revenue of all other species combined (e.g., any pelagic and reef fish which were sold). The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2001 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983–1987 were not available from the appropriate CNMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Summary Data:

	Bottomfish Species		All Species	
Year	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	75	144	124	238
1984	120	212	186	329
1985	196	333	314	534
1986	197	327	330	548
1987	303	482	517	822
1988	327	494	621	936
1989	161	229	639	907
1990	204	277	485	660
1991	130	164	316	398
1992	149	173	271	314
1993	210	233	329	365
1994	205	221	312	337
1995	310	329	365	387
1996	395	407	540	556
1997	452	461	573	584
1998	502	517	681	701
1999	566	572	731	738
2000	164	162	320	317
2001	**210**	**210**	**407**	**407**
Mean	257	313	424	530
Standard Deviation	133	134	167	208

Figure 6.—CNMI bottomfish catch in average pounds per trip.



Interpretation: The substantial increase since the low in 1992 can be primarily attributed to the Northern Islands fishery, coincident with the increase in vessels making bottomfish trips, increased revenues, and annual landings during that 8-year period. The average pounds of bottomfish landed per trip in 2000 decreased 63.1% from 1999, and recovered slightly in 2001.

Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g., changes in trip length and relative amounts of bottom fishing compared to trolling or reef fishing); it is the only measure readily obtained from the commercial landings system. However, the smaller vessels commonly make mixed trips and the relative proportions of bottom fishes to pelagic and reef fishes seem to be changing. Between 1997 and 2001, the number of fishermen selling pelagic fishes, bottomfishes and reef fishes increased from 12.1 to 16.2%, those selling both pelagic fishes and bottom fishes decreased from 11.5 to 6.8%, the number selling both pelagic and reef fishes increased from 4.8 to 7.6%, and the number selling only reef fishes increased from 10.3 to 26.1%. Given that fishermen appear to be changing the focus of their trips to include more reef fishing and less bottom fishing, this measure is an increasingly inaccurate portrayal of the actual CPUE. It has been suggested that it may be possible to improve this measure of CPUE by using only those trips that landed bottomfish exclusively. However, in the past 5 years only 2 fishermen exclusively sold bottomfishes in 1997, 1 in 1998, none in 1999, 1 in 2000, and 3 in 2001. These numbers are too low to be indicative of the entire fishery.

Calculation: The average catch per trip is calculated by dividing the total weight of all bottomfish landings by the number of trips that landed bottomfish, regardless of the amount of bottomfish landed on any given trip.

Summary Data:

Year	Pounds per Trip
1983	43
1984	69
1985	116
1986	104
1987	168
1988	179
1989	76
1990	85
1991	46
1992	59
1993	83
1994	74
1995	93
1996	119
1997	136
1998	148
1999	157
2000	57
2001	**69**
Mean	99
Standard Deviation	42

Table 3.—Bycatch during CNMI bottomfishing (totals for 2 years)

Sector	Species	Total number of interviews	Number of interviews with bycatch	Number released alive	Total number taken	% with Bycatch
Non-charter		59	1			1.69
	black jack			1	23	4.35
	dogtooth tuna			1	5	20.00
	all species			2	1508	0.13
Charter		19	3			15.79
	jobfish (uku)			1	2	50.00
	blacktip grouper			4	40	10.00
	lyretail grouper			5	6	83.33
	red snapper			4	5	80.00
	redgill emperor			6	28	21.43
	all species			20	364	5.49

Summary

Almost all fishes caught in the CNMI are considered foodfishes, including many that show a high incidence of ciguatera locally, including lyretail grouper (*Variola louti*) and red snapper (*Lutjanus bohar*). Above are all the data collected during two years (2000–2001) of interviews of fishermen during boat-based creel surveys. These data have not been reduced to per-year values. The interviews are divided into vessels engaged in non-charter (including commercial, non-commercial, and subsistence fishermen) and charter fishing. The charter fishing sector largely caters to the tourist population, of which the majority is Japanese. This sector targets blacktip grouper (*Epinephelus fasciatus*) and redgill emperor (*Lethrinus rubrioperculatus*). Catch rates in this sector must remain high to ensure that the clientele are satisfied with the charter. For this reason, small fishes are often released alive, so that they may be recaptured on subsequent charters. All bycatch, in both sectors, was released alive.

Appendix 5

NMFS 2001 Administrative Activities

Protected Species

Protected species interactions have become some of the leading issues in fishery management in the United States. With specific regard to the bottomfish fisheries in the Western Pacific Region, the concerns are focused on fishing interactions with the endangered Hawaiian monk seal. In a court action directly related to this issue, the Earthjustice Legal Defense Fund filed a complaint on behalf of the Greenpeace Foundation, Center for Biological Diversity and Turtle Island Restoration Network alleging that the U.S. Department of Commerce and NMFS, in connection with their authorization of the bottomfish and crustacean fisheries in the NWHI, have violated and are in continuing violation of the ESA, NEPA, and the Administrative Procedure Act (APA) (Greenpeace Foundation, et al. v. William M. Daley, et al. (D. Haw.) Civ. No. 00-00068 (SPK) (FIY)). In March 2001, Federal Judge Samuel King denied the plaintiffs motion for a permanent injunction of the NWHI botttomfish fishery.

NWHI Executive Order

A second environmental concern developed from a series of directives from former President Clinton that focused public attention on protection of U.S. coral reef ecosystems. Executive Order (EO) 13089, Coral Reef Protection, issued in June 1998, requires agencies to (a) identify actions that may affect U.S. coral reef ecosystems, (b) utilize their programs and authorities to protect and enhance the condition of such ecosystems, and (c) ensure that any actions they authorize, fund or carry out will not degrade the conditions of coral reef ecosystems. Agencies whose actions affect U.S. coral reef ecosystems must provide for implementation of measures needed to research, monitor, manage and restore affected ecosystems, including, but not limited to, measures reducing impacts from pollution, sedimentation and fishing. The EO also established the U.S. Coral Reef Task Force composed of the heads of 11 federal agencies and the Governors of seven states, territories or commonwealths with responsibilities for coral reefs. In March 2000, the Task Force issued the National Action Plan to Conserve Coral Reefs, which presents a cohesive national strategy to implement EO 13089.

In May 2000, the President issued a Memorandum stating that it is time to implement the Coral Reef Task Force's recommendations to ensure the comprehensive protection of the coral reef ecosystem of the Northwestern Hawaiian Islands (NWHI).[1] The Memorandum directed the

[1] The President's directive coincided with Executive Order 13158, which requires federal agencies to establish a comprehensive national network of marine protected areas (MPAs) throughout U.S. marine waters. The executive order calls for expansion of the nation's MPA system to include examples of all types of U.S. marine ecosystems. According to the executive order, a MPA means any area of the marine environment that has been reserved by federal, state, territorial, tribal or local laws or has regulations to provide lasting protection for part or all of the natural and cultural resources therein.

Secretaries of Interior and Commerce, in cooperation with the State of Hawai'i and in consultation with the Council, to develop recommendations for a new, coordinated management regime to increase protection for the NWHI coral reef ecosystem and provide for sustainable use. Upon consideration of their recommendations and comments received during the public visioning process on this initiative, President Clinton issued EO 13178 on December 4, 2000, establishing the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, pursuant to the National Marine Sanctuaries Amendments Act of 2000 (NMSA). The EO was revised and finalized by EO 13196, issued January 18, 2001. In establishing the Reserve, the Executive Orders set forth a number of conservation measures, including the creation of Reserve Preservation Areas in which fishing is restricted. Pursuant to EO 13178 and the NMSA, the National Oceanic and Atmospheric Administration (NOAA) is initiating the process to designate the Reserve as a national marine sanctuary (66 FR 5509, January 19, 2001).

Use-it or Lose it Requirement for Permit Renewal (Calendar Yr 2000)

Mau Zone limited entry permits expire on December 31 each year. NMFS will renew a permit for the following year if the permit holder's vessel made a minimum of 5 separate landings, each of which consisted of at least 500 pounds of bottomfish management unit species, from the Mau Zone during the previous permit year. Failure to meet the required landing requirement may result in the permit being lost (not renewed). All 2001 Mau Zone limited entry permit holders will be required to meet this permit renewal requirement.

Northwestern Hawaiian Islands (NWHI) Bottomfish Fisheries

During calendar year 2001, The Pacific Islands Area Office (PIAO) in Honolulu, issued a total of 9 permits for the NWHI bottomfish fishery. Four vessels were registered for the Ho'omalu Zone fishery; 5 vessels were registered with Mau Zone permits.

Ho'omalu Zone vessels:

1. Ka Imi Kai
2. Fortuna
3. Laysan
4. Kealailani

Mau Zone vessels:

1. Kai Pali
2. Imua
3. Wahine Kapaloa
4. Jamie Elizabeth
5. Iwa lani

Appendix 6

Enforcement Activities

United States Coast Guard Enforcement Activities

The United States Coast Guard (USCG) conducted roughly 799 hours of fisheries patrols with C-130 aircraft in the Central and Western Pacific ocean during fiscal year 2001. This was a significant decrease from FY 2000 due to operating tempo and budget reductions made during the year. They also undertook a major upgrade to the electronic sensors on their fleet of C-130s. All of the aircraft had to travel to the mainland for up to three months each, as the upgrade was accomplished. This impacted the USCG ability to deploy, and overall there was a significant reduction in the total number of C-130 hours flown in support of fisheries enforcement.

The C-130 surveillance of the eight non-contiguous EEZ s was broken down as follows: 60 hours in the Main Hawaiian Islands, 3 hours in the Northwest Hawaiian islands, 90 hours in Guam and the Northern Mariana Islands, 41 hours in American Samoa, 30 hours in Palmyra Atoll/Kingman Reef, 34 hours in Jarvis Island, and 8hours in Howland/Baker Islands.

In FY 2001, over 300 cutter days of fisheries patrol was conducted in the Central and Western Pacific ocean. There were over 500 fishing vessel boardings. The breakdown of vessels boarded is as follows: 400 were U.S and 107 were foreign.

It is estimated that 46 EEZ encroachments by foreign fishing vessels occurred in FY 2001 and only two suspected violators were intercepted by Coast Guard units.

NOAA Fisheries Office for Law Enforcement Southwest Enforcement Division

Marine Mammal Protection Act:
Public education, deterrence, and intervention remained the primary focus of NOAA Fisheries Office of Law Enforcement with regards to averting marine mammal harassment within Hawaii. Several marine mammal investigations were initiated during this reporting period, to include violations of the Humpback Whale approach regulations by recreational water craft in Kailua-Kona, Hawaii and Kihei, Maui, the mauling of a Hawaiian Monk Seal on the island of Kauai by a Pit Bull terrier, and harassment of spinner dolphins on the Big Island. Coordination continued with volunteer organizations and local law enforcement agencies, in order to provide a timely response to marine mammal incidents.

In addition, several contraband investigations involving marine mammal products were initiated. Purported medicinals containing marine mammal parts were intercepted and seized prior to their introduction into local markets. Exotic medicinals containing ingredients extracted from seals were intercepted prior to their introduction into local commerce on Oahu. These purported remedies pose an additional threat to public health and safety due to the fact that they are

remedies pose an additional threat to public health and safety due to the fact that they are routinely adulterated with dangerous levels of heavy metals, to include arsenic and mercury. Handbags constructed of seal skin and sperm whale teeth were also intercepted and seized prior to their introduction into local commerce in Hawaii.

A NMFS special agent stationed on Oahu conducted several enforcement workshops for members of the U.S. Coast Guard and the Hawaii Department of Conservation and Resources Enforcement Division in 2001, which concentrated on various aspects of the MMPA and ESA relative to the Humpback Whale Sanctuary on the Big Island of Hawaii.

Marine Sanctuaries Act:
Vessel based patrols resumed near American Samoa's Fagatele Bay National Marine Sanctuary in 2001. Suspected coral damage was investigated and assessed by the resident NMFS special agent. Enforcement activities have resulted in note-worthy civil penalties for violators of the MSA in American Samoa's Fagatele Bay National Marine Sanctuary.

Public education efforts in conjunction with the Humpback Whale Sanctuary Enforcement Workshops were conducted in November of 2001. Consistent with previous years, public education, deterrence, and intervention strategies were maintained throughout the 2001-2002 whale watching season. The NOAA Office for Law Enforcement was also represented on the Hawaiian Islands Humpback Whale National Marine Sanctuary Advisory Council. The Assistant Special Agent in Charge was recently appointed to sit on the Council in an advisory capacity.

In order to address the unique challenges posed by the creation of the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, the NOAA OLE designated a special agent to coordinate enforcement activities and public education relative to the reserve.

Endangered Species Act:
Cooperative enforcement efforts continued between the Hawaii NMFS Office of Enforcement and the Hawaii Division of Conservation and Resources Enforcement regarding the status of sea turtles at Punalu'u Beach, on the Big Island of Hawaii. Furthermore, NOAA OLE agents investigated the destruction of sea turtle nests on the island of Molokai. NMFS OLE agents also investigated the illegal take of two mature Green Sea Turtles on Kauai. Upon discovery, one turtle was dead, and the other was mortally wounded and was later euthanasized.

At the outset of March, NOAA Fisheries special agents arrested a 34 year old Kauai man pursuant to a warrant charging him with four separate counts of violations of the Endangered Species Act, to include the unlawful taking and possession of adult green sea turtles. Defendant Daniel Isobe was sentenced to a term of 6 months in federal prison on Monday, April 30th, after entering a guilty plea to Counts 1 and 5 of a Superseding Information to wit, knowingly taking 2 Green Sea Turtles, a threatened species of wildlife in violation of the Endangered Species Act, and knowingly transporting same in violation of the Lacey Act. The six month custodial term was imposed by Magistrate Judge Barry M. Kurren for the District of Hawaii.

While on assignment to the Hawaiian Islands Humpback Whale National Marine Sanctuary, NOAA Office for Law Enforcment special agents investigated 39 alleged violations and five whale collisions with recreational watercraft. In addition, public education efforts continue in conjunction with the Humpback Whale Sanctuary Enforcement Workshops. NMFS OLE agents participated in a comprehensive review of the current Hawaii's Ocean User's Handbook. Consistent with previous years, public education, deterrence, and intervention strategies was maintained throughout the 2001 whale watching season.

Forum Fisheries Agency:
The resident NMFS special agent in Guam continued to be available to conduct enforcement workshop sponsored by the Forum Fisheries Agency for member countries.. He was responsible for developing and teaching a comprehensive fisheries enforcement workshop which was held in Chuuk, FSM , with both classroom and practical field training exercises spanning two weeks, at the close of January, 2001. Similar training programs were also conducted on the island nation of Vanuatu, in November, 2000. The resident NOAA Fisheries Enforcement agent has also conducted several training sessions for personnel from the maritime unit from Guam Customs and Quarantine.

Monitoring, Control and Surveilance
NOAA Fisheries Southwest Enforcement hosted the initial efforts to develop an international network of agencies that are involved in fisheries-related monitoring, control, and surveillance (MCS) around the world. The country participants in the International Conference on Monitoring, Control, and Surveillance indicated their intention to create this network for the coordination of fisheries-related enforcement in Santiago, Chile, in January 2000. The objectives of the "International MCS Network" are to improve the efficiency and effectiveness of MCS activities through enhanced cooperation, coordination, and information collection and exchange among national organizations and institutions.

Participation in the MCS program is voluntary, and nations will achieve the aforementioned objectives through the following activities: (a) identifying their national organizations/institutions responsible for fisheries-related MCS, and the primary contact person who shall act as the main national coordinator for the purposes of this network; (b) collecting and providing timely and accurate MCS information to other parties to the arrangement; (c) considering requests and, where appropriate and possible, cooperating in joint fisheries-related MCS activities; (d) promoting technical assistance, training, experience exchange, and institutional development, to increase MCS knowledge and capability amongst participating parties; and (e) considering the particular needs and obstacles faced by developing countries.

Appendix 7

2001 Bottomfish Plan Team Members

Fini Aitaoto
Dept. Of Marine and Wildlife Resources
P.O. Box 3730
Pago Pago, AS 96977
PH:(684) 633-4456
FAX:(684) 633-5944
email: DMWR@samoatelco.com

Don Heacock
Hawaii Division of Aquatic Resource
3060 Eiwa Street, #306
Lihue, HI 96766
PH:(808) 274-3344
FAX:(808) 274-3448
e-mail: don@dar.ccmail.compuserve.com

Walter Ikehara
Hawaii Division of Aquatic Resources
1155 Punchbowl Street, #330
Honolulu, HI 96813
PH: (808) 243-5834
FAX: (808) 243-5833
email:skippy@dar.ccmail.compuserve.com

Kurt Kawamoto
NMFS, Honolulu Lab.
2570 Dole Street
Honolulu, HI 96822
PH: (808) 983-5326
FAX: (808) 983-2902
email: kurt.kawamoto@noaa.gov

Robert Moffitt (Chairman)
NMFS, Honolulu Lab.
2570 Dole Street
Honolulu, HI 96822
PH: (808) 983-5373
FAX: (808) 983-2902
email: robert.moffitt@noaa.gov

Thomas Flores
DAWR, Dept. Of Agriculture, Guam
192 Dairy Road
Mongilao, Guam 96923
PH: (671) 735-3986
FAX: (671) 734-6570
email: tfloresjr@hotmail.com

Kate Moots
Division of Fish and Wildlife, CNMI
P.O. 10007
Saipan MP 96950
PH: (670) 322-3441
FAX: (670) 322-3470
email: KATEMOOTS@saipan.com

Ex-officio Members:

David Hamm
NMFS. Honolulu Lab.
2570 Dole Street
Honolulu, HI 96822
PH: (808) 983-5330
FAX: (808) 983-2902
email: david.hamm@noaa.gov

Sam Pooley
NMFS, Honolulu Lab
2570 Dole Street
Honolulu, HI 96822
PH: (808) 983-5320
FAX: (808) 983-2902
email: samuel.pooley@noaa.gov

Council Staff:

Mark Mitsuyasu
PH: (808) 522-6040
email: mark..mitsuyasu@noaa.gov

Western Pacific Fishery Council
1164 Bishop Street #1400
Honolulu, HI 96813
PH: (808) 522-8220
FAX: (808) 522-8226
www.wpcouncil.org

Appendix 8

GLOSSARY

TERM	DEFINITION
Alia	Samoan fishing catamaran, about 30 feet long, constructed of aluminum or wood with fiberglass. Used for various fisheries including trolling, longline, and bottomfishing
AP	Advisory Panel. Appointed industry/government/educational representatives functioning in an advisory capacity to the Council.
Armorhead	Groundfish found on the SE Hancock Seamount in the Northwestern Hawaiian Islands
AS or American Samoa	Includes the islands of Tutuila, Manua, Rose and Swains Atolls.
ASDPW	Department of Public Works, American Samoa. Also, DPW.
BARB	Bottomfish Advisory Review Board
BMUS	Bottomfish Management Unit Species, include deep and shallow water bottomfish species
BPT or PT	Bottomfish Plan Team. Advisory body to the Council composed of scientists and fishermen who monitor and manage the fisheries under the jurisdiction of the Bottomfish and Seamount Groundfish FMP.
Bycatch	Fish caught in a fishery but discarded or released, except in a recreational fisheries catch and release program.
Commercial	Commercial fishing, where the catch is intended to be sold, bartered, or traded.
CNMI or the Commonwealth of the Northern Mariana Islands	Also, Northern Mariana Islands, Northern Marianas, and NMI. Includes the islands of Saipan, Tinian, Rota, and many others in the Marianas Archipelago.
CPUE	Catch-Per-Unit-Effort. A standard fisheries index usually expressed as numbers of fish caught per unit of gear per unit of time, eg., number of fish per hook per line-hour or number of fish per 1,000 hooks. The term catch rate is sometimes used when data are insufficiently detailed to calculate an accurate CPUE.
DAWR	Division of Aquatic & Wildlife Resources, Territory of Guam.
DBEDT	Department of Business, Economic Development & Tourism, State of Hawaii.

DFW	Division of Fish & Wildlife, Northern Mariana Islands.
DLNR	Department of Land & Natural Resources, State of Hawaii.
DMWR	Department of Marine & Wildlife Resources, American Samoa. Also, MWR.
EEZ	Exclusive Economic Zone, refers to the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending out 200 nautical miles from shore. Within the U.S., the EEZ typically is between three and 200 nautical miles from shore.
ESA	Endangered Species Act. An Act of Congress passed in 1966 that establishes a federal program to protect species of animals whose survival is threatened by habitat destruction, overutilization, disease etc.
FAD	Fish Aggregating Device; a raft or pontoon, usually tethered, and under which, pelagic fish will concentrate.
FDCC	Fishery Data Coordinating Committee, WPRFMC.
FFA	Forum Fisheries Agency. An agency of the South Pacific Forum, which comprises the independent island states of the South Pacific, Australia and New Zealand. The FFA formed to negotiated access agreements between FFA member countries and distant water fishing nations such as Japan and the USA.
FMP	Fishery Management Plan.
GU or Guam	A U.S. territory in the Marianas Archipelago. South of and adjacent to the Commonwealth of Northern Marianas Islands.
HI or Hawaii	U.S. state. See MHI, NWHI. Composed of the islands, atolls and reefs of the Hawaiian Archipelago from Hawai'i to Kure Atoll, except Midway Islands. Capitol - Honolulu.
HDAR	Hawaii Division of Aquatic Resources. Also, DAR.
HIMB	Hawaii Institute of Marine Biology, University of Hawaii.
Hoomalu Zone	Limited entry bottomfish management area located in the northwestern Hawaiian Islands, includes area from French Frigate Shoals to Kure atoll, including Hancock seamount.
Incidental Catch	Fish caught that are retained in whole or part, though not necessarily the targeted species. Examples include monchong, opah and sharks.
Interaction	Catch of protected species, which is required to be released. Examples: Hawaiian monk seals, marine turtles and albatrosses.
Logbook	Journal kept by fishing vessels for each fishing trip; records catch data,

Mau Zone	Limited entry bottomfish management area located north of Kauai to Necker Island at 165° W.
MFCMA	Magnuson Fishery Conservation and Management Act of 1976. Also, Magnuson-Stevens Fishery Conservation and Management Act of 1996. Sustainable Fisheries Act.
MHI	Main Hawaiian Islands (comprising the islands of Hawai'i, Mau'i, Lana'i, Moloka'i, Kaho'olawe, O'ahu, Kauai', Ni'ihau and Ka'ula).
MSY	Maximum Sustainable Yield.
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. Also NOAA Fisheries.
NOAA	National Oceanic and Atmospheric Administration, Department of Commerce.
NWHI	Northwestern Hawaiian Islands. All islands in the Hawaiian Archipelago, other than the Main Hawaiian Islands (MHI).
OY	Optimum Yield.
PIAO	Pacific Islands Area Office, National Marine Fisheries Service. Also, NMFS/PIAO.
Protected	Refers to species which are protected by federal legislation such as the Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act. Examples: Black-footed and Laysan albatrosses, marine turtles, dolphins.
Recreational	Recreational fishing for sport or pleasure, where the catch is not sold, bartered or traded.
SAFE	Stock Assessment and Fishery Evaluation, NMFS.
Sanctuary	Protected area. Commercial/recreational fishing may be restricted.
Secretary	When capitalized and used in reference to fisheries within the U.S. EEZs, it refers to the U. S. Secretary of Commerce.
SPC	Secretariet of the Pacific Community. A technical assistance organization comprising the independent island states of the tropical Pacific Ocean, dependant territories and the metropolitan countries of Australia, New Zealand, USA, France and Britain.
SPR	Spawning Potential Ratio. A term for a method to measure the effects of fishing pressure on a stock by expressing the spawning potential of the fished biomass as a percentage of the unfished virgin spawning biomass. Stocks are deemed to be overfished when the SPR<20%.
SSC	Scientific & Statistical Committee, an advisory body to the Council

Trolling	Fishing by towing lines with lures or live-bait from a moving vessel.
USCG	U.S. Coast Guard, 14th District, Department of Transportation.
USFWS	U.S. Fish & Wildlife Service, Department of Interior. Also, FWS.
VMS	Vessel Monitoring System. A satellite based system for locating and tracking fishing vessels. Fishing vessels carry a transponder which can be located by overhead satellites. Two-way communication is also possible via most VMS systems.
WPacFIN	Western Pacific Fishery Information Network, NMFS.
WPRFMC	Also, the Council. Western Pacific Regional Fishery Management Council. One of eight nationwide fishery management bodies created by the Magnuson Fisheries Conservation and Management Act pf 1976 to develop and manage domestic fisheries in the U.S. EEZ. Composed of American Samoa, Guam, Hawaii, and Commonwealth of Northern Mariana Islands.